1938 TWELFTH 1940 BIENNIAL REPORT

STATE OF NEVADA DEPARTMENT OF HIGHWAYS

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Arch bridge west of Verdi. One of first bridges constructed with 26-foot roadway. This eliminated obsolete bridge and dangerous alignment on U S 40.

STATE OF NEVADA

TWELFTH BIENNIAL REPORT

OF THE

DEPARTMENT OF HIGHWAYS

For the Period
July 1, 1938, to June 30, 1940, Inclusive

CARSON CITY, NEVADA
STATE PRINTING OFFICE - - JOE FARNSWORTH, SUPERINTENDENT
1941

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STATE HIGHWAY OFFICIALS

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LETTER OF TRANSMITTAL

HONORABLE E. P. CARVILLE, *Governor of the State of Nevada, Carson City, Nevada.*

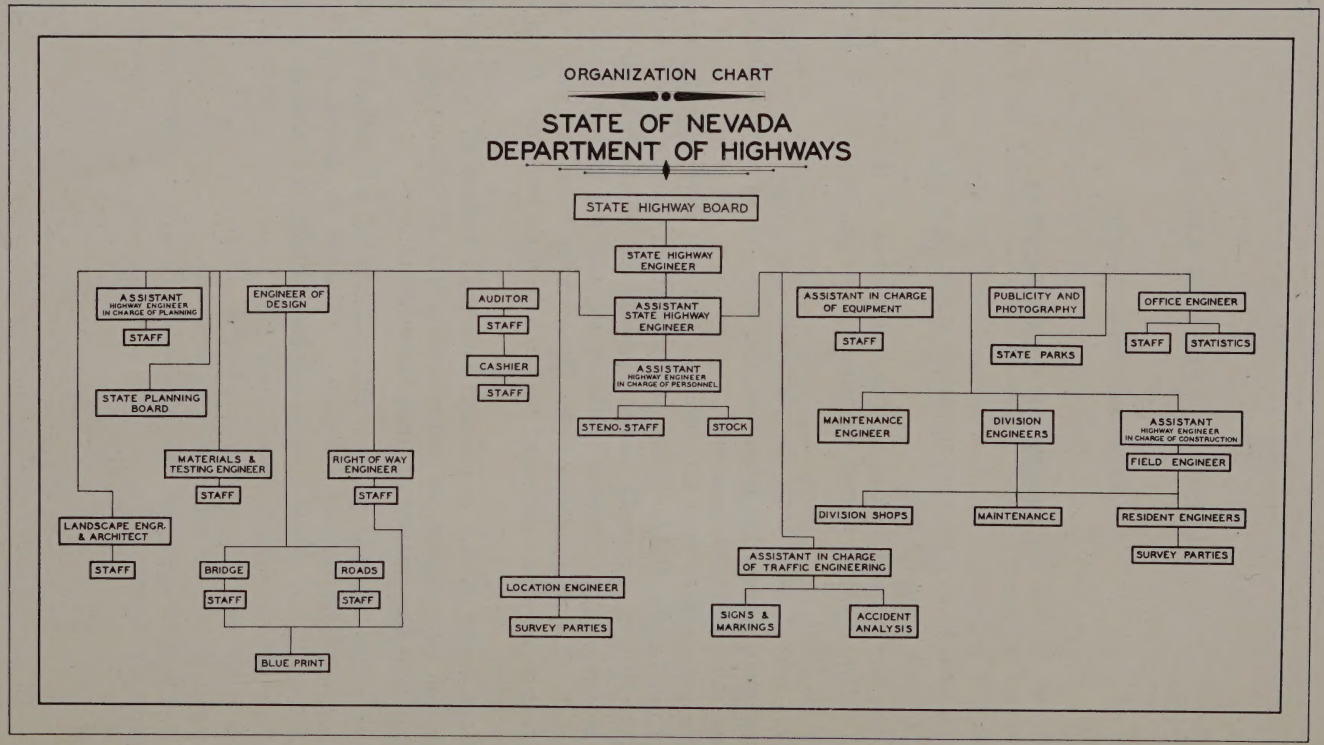
DEAR GOVERNOR CARVILLE: The Department of Highways presents its Twelfth Biennial Report covering the period from July 1, 1938, to June 30, 1940.

This report sets forth the rhythmic operations of the Highway Department during the biennium, and also indicates the construction program for the next fiscal year.

We again call to your attention the fact that the fine cooperation of the United States Public Roads Administration, County Commissioners, and the citizens of Nevada continued during the biennium to the mutual advantage of the electorate of this State, and the traveling public in general. The employees of the Department have, by their wholehearted cooperation, advanced the work in their respective fields very materially.

Much credit is due to yourself and the members of the Board of Directors for valuable aid and encouragement in conducting the business of this Department of State Government.

DEPARTMENT OF HIGHWAYS,
ROBERT A. ALLEN,
State Highway Engineer


ORGANIZATION CHART
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
STATE HIGHWAY BOARD
STATE HIGHWAY ENGINEER
ASSISTANT HIGHWAY ENGINEER IN CHARGE OF PLANNING
STAFF
STATE PLANNING BOARD
ENGINEER OF DESIGN
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SURVEY PARTIES
ASSISTANT STATE HIGHWAY ENGINEER
ASSISTANT HIGHWAY ENGINEER IN CHARGE OF PERSONNEL
STENO. STAFF
STOCK
ASSISTANT IN CHARGE OF EQUIPMENT
STAFF
ASSISTANT IN CHARGE OF TRAFFIC ENGINEERING
SIGNS & MARKINGS
ACCIDENT ANALYSIS
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RESIDENT ENGINEERS
SURVEY PARTIES

TWELFTH BIENNIAL REPORT OF THE DEPARTMENT OF HIGHWAYS

In the Biennial Reports of the Highway Department made prior to the completion of the field work and basic study authorized under the Statewide Highway Planning Survey, there was a lack of uniformity of presentation of the problems of the highway industry.

We call to your attention the new arrangement of this report and the more logical method of approach to the requirements of the citizens of this State in the construction, maintenance, and operation of the road system. Based upon the present traffic densities as well as a comprehensive forecast of the increase in traffic, it is now possible (by using the findings of the Statewide Planning Survey) to arrive at a longer construction program than was heretofore possible.

The Highway Board has consistently viewed the road problem in its broad State-wide aspect, and has approved construction work so that roads included were brought to modern standards according to the actual necessities and to meet the traffic needs of the traveling public.

In various following sections of this statement there will be found the details of each operation of your Department.

Since this Department has grown from a very few people in 1917 to one of your biggest businesses, employing hundreds of people and providing a livelihood for a large portion of the citizens of this State, both directly and indirectly supplying materials for construction, materials for operation of cars, food stuffs, etc., for that so-called back-line army, all supported by the automotive industry of this State, it is timely that we review the methods and procedure governing the activities of this organization.

To, in a measure, answer the question raised by the layman as to why, after a road survey has been made, new construction is so late in getting started and what money is to be used and from what sources it is derived, we offer an historic review of road building as it affects this State.

Public Roads Administration, through its predecessor, was created in 1893 as an office of roads inquiry, with a staff to teach others how to build roads. For 19 years it continued investigation, study, and teaching of road building. In 1912 it launched upon a new career of actual participation in construction by contributing $500,000 to 29 counties scattered over 13 States. This procedure, in accordance with the wish of Congress, was directed by the Secretary of Agriculture in cooperation with the Postmaster General, and resulted in the selection of a system of post roads eligible for Federal participation. Only 426 miles were included in the program, with the counties and States contributing the greater share to make a total expenditure of $1,800,000 within the next following five-year period. In 1916 new legislation, very much broadened in nature, provided for Federal Aid appropriations amounting to $75,000,000, to be expended over a five-year period in all States for roads "over which the United States mails now are or may hereafter be transported."

New west approach to the arch bridge west of Verdi, U S 40. This alignment eliminates two dangerous approach curves on narrow obsolete bridge.

In 1917 the State of Nevada entered the picture by the creation of its State Highway Department and the resultant enjoyment of some Federal Aid. The Federal Aid Act provided that Federal appropriations, in an amount of only 50 percent of construction costs, would be available, and required the States to bear costs of administration, acquirement of rights-of-way, surveys, and plans, thus limiting Nevada to a minor network of highway projects.

In 1921 Congress amended its road legislation and adopted the graduated scale as a rule or formula to permit public lands States in the same category as Nevada to really develop a road system. The formula for determining the percentage of Federal participation where State funds are required to match is: In any State with more than 5 percent of public-owned lands, the proportion payable by the government will be the arbitrary figure of 50 percent, plus an amount which equals one-half the percentage of unappropriated public lands in the State. The computation arrived at for the various States is indicated in the following tabulation published by the Public Roads Administration to show the corresponding percentages payable to 14 western States for the year 1939:

Nevada	86.01	California	58.51
Utah	74.38	Montana	56.72
Arizona	72.12	Colorado	56.36
Wyoming	63.13	South Dakota	55.07
New Mexico	62.41	North Dakota	53.60
Idaho	61.12	Oklahoma	53.22
Oregon	60.46	Washington	52.34

For the year 1940, Nevada's percentage of Federal Aid was 87.18. This percentage has varied throughout the years in accordance with the fluctuation in the area of Public Lands, which usually ranges between 72 and 75 percent, and results from the patenting of mining ground, relinquishing homesteads, and adjustment of areas under the Grazing Act.

Further significance in the 1921 legislation was the retaining of the original formula which distributes funds among the 48 States in the following proportion:

(1) One-third for population.
(2) One-third for area.
(3) One-third for mileage of rural post roads.

A minor exception to the above is that in no State the apportionment shall be less than one-half of one percent for any year.

The Act also provided for the designation of a Federal Aid Highway System upon which Federal funds *must* be spent. This network, commonly referred to as the 7 percent system, consisted of the main intercounty and interstate roads amounting to not more than 7 percent of the rural highways of the State. In 1920 and early 1921, the State Highway Department, cooperating with County Commissioners, Road Supervisors, and other county officials familiar with the rural roads, logged and compiled a system, the total of which amounted to 22,000 miles. Seven percent of this, or 1,540 miles, then became Nevada's Federal Aid Highway System.

The Act also provided that when 90 percent of the Federal Aid Highway System has been improved, the mileage may be increased. Nevada has availed itself of this opportunity twice. In each case with an addition of one percent. At this time the total of the Federal Aid Highway System is 1,980 miles, or nine percent of the total rural mileage.

Federal funds originally were available for expenditure only in rural areas, but a later amendment allowed participation through municipalities.

An annual appropriation usable for road building on the public domain only, and known as the Federal lands appropriation, has been available for several years. Federal regulations require the expenditure of this money in the construction of highways either on the Federal Aid System, roads on the State Highway System which provide connections between two Federal Aid routes, and State Highway routes connecting with the State Highway Systems of bordering States. The

Shoshone o[redacted]pass as seen from railroad.

usual annual allotments to this State are approximately one-half million dollars. This is a 100 percent Federal fund and does not require participation on the part of the State, although in most instances the work is administered under the direction of the State Highway Department.

In 1938 the Federal program of road building was further broadened, and funds became available for the building of the so-called secondary or farm-to-market or mine-to-market roads. This fund *must* be met in the same proportion as the Federal Aid Fund. Roads under this category are important roads selected by the State and Federal Government, and not in the Federal Aid or 9 percent System. The mileage of this system is not to exceed 10 percent of the rural mileage, and the selection of this mileage is based on factual surveys made and developed by the State Highway Planning Survey.

Another very important addition to the Federal Aid program of 1938 was that pertaining to the elimination of grade crossings by the building of overpasses and underpasses. The formula for apportioning funds for grade crossing separation is:

(1) One-half in proportion to population.
(2) One-fourth to railroad mileage in the State; and
(3) One-fourth in proportion to the mileage of the Federal Aid System.

Use of the grade-crossing funds has not been restricted to any particular highway system, but is available primarily for protection at the most dangerous crossings. These funds like the Federal lands funds need no matching with State funds.

To recapitulate:

(1) Federal Aid funds can be used only on the Federal Aid System as designated.

(2) Federal Lands funds can be used only on highways through public lands and either on the Federal Aid System or on the State System, or on the State System in conjunction with Feeder Road funds and where such road is a connecting link between Federal Aid routes or the road system of this State and an adjoining State, but only through public lands.

(3) Feeder road funds can be used only on the designated Feeder Road or Secondary Road System, which comprises farm-to-market, mine-to-market, or feeder roads, and cannot be used on the Federal Aid System.

(4) Grade Crossing funds are not restricted to any particular highway system, but are available primarily for protection of the traveling public at the most dangerous railroad crossings.

To clarify the above-described Federal-State road building funds, we list all types and amounts of funds included in the Federal highway bill enacted recently:

(1) Federal Aid System	$100,000,000
(2) Secondary roads	17,500,000
(3) Grade crossings	20,000,000
(4) Federal land roads	1,500,000
(5) Forest highways	10,000,000
(6) National park roads	4,000,000
(7) Parkways	7,500,000
(8) Indian roads	3,000,000
	$163,500,000

The amount of $163,500,000, as totaled, is available for each of the fiscal years 1942 and 1943, being the periods from July 1, 1941, to June 30, 1942, and from July 1, 1942, to June 30, 1943. The fiscal years for the Government and for Nevada are identical.

In the above tabulation, items 1, 2, 3, and 4 are the only funds spent under the supervision and direction of the State Highway Department. Of course, these are always subject to approval and inspection by Federal engineers. Items 1 and 2 will be matched on the ratio of 87.18 percent Federal funds and 12.82 percent State funds, based on the present rate. Items 3 and 4 are 100 percent Federal participation

and no State matching is required. Items 5, 6, and 7 are usually, if not always, designed and constructed directly through the Public Roads Administration. Item 8 is handled directly by the Indian Service. No State funds are ever involved.

Of the above appropriations, Nevada's share for each of the fiscal years 1942 and 1943 amount to:

(1) Federal Aid System	$1,271,000
(2) Secondary roads	222,000
(3) Grade crossings	97,000
(4) Federal land roads	327,000
	$1,917,000

These funds becoming available, bring into play the following procedure. Surveys are made, plans are drawn, rights-of-way are secured. The design of the road is made, call for bids advertised during a 15-day period, and the contract entered into. All of the details of this procedure may be found in the following pages.

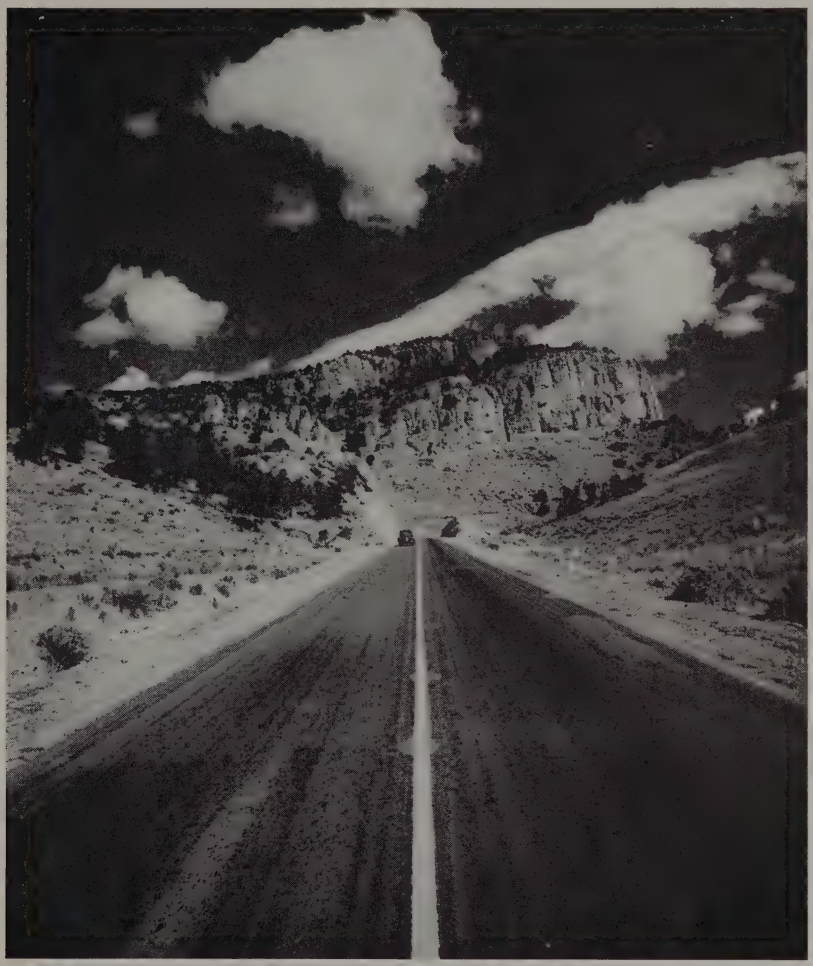
We call to your attention the very vital feature that with the improvement of your highway system to modern standards, we have still not been able to appreciably reduce the death rate on the highways of the State. A perusal of this report indicates that center-striping has been used, large signs installed, and every facility provided to warn the traveler of the road conditions ahead. From observation, one additional feature may be invoked which will give additional warning and safeguard the lives of the travelers. Authority should be given to the Highway Department to zone the highways for speed; for instance, curves should be so marked with illuminated signs as to warn the traveler that the safe speed on that particular curve is so many miles per hour. It is to be hoped that the people of the State will take increased interest in their biggest business and will visit the various divisions of the State Highway Department, where they will always find a welcome, and that in visiting these places they will become more definitely a part of an educated electorate, alive to the needs of safe and sane traffic along the highways of this State.

TENTATIVE HIGHWAY CONSTRUCTION

This biennium has brought forth considerable improvement in highway design, as well as construction methods. The increasing use of Nevada's highways, not only by pleasure cars, but by heavy trucks and busses, is requiring reconstruction, as speedily as funds become available, of such routes as U S 40, 91, and 395. Prior to reconstruction of any section of road a resurvey is made. Horizontal curves are flattened and vertical curves lengthened to obtain as much sight distance as possible; in some instances the entire section is relocated in order to eliminate hazards and place the highway on a location that will be permanent.

The increase in traffic has, naturally, required a change in the design of the roadway. On all new work the roadway is designed for widths of 38 feet to 40 feet, with paved surface widths of 22 feet and 24 feet, and shoulders 8 feet wide. This design pertains to primary or heavily traveled routes only.

Previous to preparation of plans for new construction and reconstruction, a field survey of the soils to be encountered is made under the direction of the Materials and Research Laboratory. Samples of the soils within the roadway section are obtained, and tests made to determine the stability of each type that will be used in the subgrade. These tests also indicate the amount of compaction that will be required.



U S 40 at Cliffside east of Wells.

Tests are also made of all materials to be incorporated in the roadway prior to their use.

Details of testing methods, materials tested, and the need for making them are contained elsewhere in this report in the section devoted to "Materials and Research."

Required construction and reconstruction to be financed with fiscal

year 1942 funds and placed under way during the calendar year 1941 follows:

ON FEDERAL AID SYSTEM

Approximate Amount of Federal Funds, $1,271,000

Clark—U S 93, 10 miles southeast of Las Vegas to Las Vegas. Stabilize base, widen, low cost bituminous surface, length 10.18 miles.

Clark— U S 93, Las Vegas southeast city limits to Fourteenth Street. Stabilize base, widen, low cost bituminous surface, length 1 mile.

Elko—U S 40, west limits city of Elko to Third Street. Realign, widen, low cost bituminous surface, length 1.22 miles.

Elko—U S 40, Elko to Osino Hill. Minor alignment and grade changes, widen, low cost bituminous surface, length 10 miles.

Elko—U S 40, Welcome to 1½ miles west of Wells. Minor alignment and grade changes, widen, low cost bituminous surface, length 5.86 miles.

Eureka—U S 40, 5 miles east of Dunphy to 2 miles west of Primeaux. Realign, widen, low cost bituminous surface, length 6.32 miles.

Eureka—U S 40, 2 miles west of Primeaux to ½ mile west. Realign, widen, low cost bituminous surface, length 1.56 miles.

Humboldt—U S 40, 3 miles east of Button Point to Golconda. Minor alignment and grade changes, widen, low cost bituminous surface, length 2.48 miles.

Humboldt—U S 40, Golconda to 8½ miles east. Minor alignment and grade changes, widen, low cost bituminous surface, length 8.47 miles.

Humboldt—U S 40, 8½ miles east of Golconda to 11½ miles east. Low cost bituminous surface, staggered shoulder widening, length 2.91 miles.

Lyon—U S 40, 5 miles northeast of Fernley to Lyon-Churchill County line. Stabilize base, widen, low cost bituminous surface, length 8.61 miles.

Lyon—U S 40, approaches to Fernley overpass (portion). Grade change, widen, low cost bituminous surface, length .25 mile.

Pershing—U S 40, ½ mile west of Mill City to Mill City. Minor alignment and grade changes, widen, low cost bituminous surface, length 0.53 mile.

Pershing—U S 40, Mill City to ½ mile west of Pershing-Humboldt County line. Minor alignment and grade changes, widen, low cost bituminous surface, length 13.31 miles.

Washoe—U S 40, Sparks to Vista. Stabilize base, widen, low cost bituminous surface, length 2.54 miles.

Washoe—U S 40, Vista to 1 mile east. Realign, widen, low cost bituminous surface, length 1 mile.

SECONDARY OR FEEDER ROADS

Approximate Amount of Federal Aid Secondary Funds, $222,000

PROJECT ON STATE HIGHWAY SYSTEM

Lyon—5 miles south of Fernley to Fernley (portion). Low cost bituminous surface, length 3.86 miles.

PROJECTS OFF STATE HIGHWAY SYSTEM

Clark—4½ miles northwest of Nelson to Nelson. Grade, gravel, low cost bituminous surface, length 4.46 miles.

Elko—1 mile south of Elko to 5 miles southeast toward Lamoille. Grade, drain, gravel surface, length 5 miles.

Lincoln—Pioche to Castleton. Grade, gravel, low cost bituminous surface, length 2.60 miles.

Nye—Junction S R 8A to Manhattan. Grade, drain, gravel surface, length 6.60 miles.

Washoe—Asylum road to Glendale. Grade, gravel, low cost bituminous surface, length 2.25 miles.

FEDERAL LANDS HIGHWAYS

Approximate Amount of Federal Lands Funds, $327,000

Clark—U S 95, California-Nevada, State line to 7 miles south of Searchlight. Gravel, low cost bituminous surface, length 13.30 miles.

Lander—S R 8A, 48 miles south of Battle Mountain to 63 miles south. Grade, drain, gravel surface, length 15 miles.

Nye—U S 6, 2 miles east of Warm Springs to Sandy Summit. Gravel, low cost bituminous surface, length 20.74 miles.

White Pine—U S 6, Sacramento Pass to 7 miles west of Utah State line. Grade, drain, gravel surface, length 10 miles.

GRADE CROSSING PROJECTS

Approximate Amount of Federal Aid Grade Crossing Funds, $97,000

Lincoln—U S 93, crossing of Pioche-Castleton Branch U. P. R. R. north of Pioche. Install flashing light grade crossing signals. U. P. Co.

Lyon—U S 40, approximately 1 mile east of Fernley. Widen existing overpass and approaches. S. P. Co.

Washoe—City street, Keystone Street crossings S. P. R. R. in city of Reno. Install flashing light grade crossing signals. S. P. Co.

Washoe—County road, Aslyum road crossing S. P. R. R. Install flashing light grade crossing signals. S. P. Co.

PLANNING SURVEY

The State-wide Highway Planning Survey, instituted in 1936 as a section of the State Highway Department by direction of and as a cooperating agency of the Bureau of Public Roads, has developed basic data essential to the study of a plan of highways to better and more economically serve the people of this State and those visitors who are arriving at our borders in constantly increasing numbers each year.

For those readers not familiar with the functions of the Survey, we repeat that planning is a primary activity carried on to a greater or less degree in every phase of life, in every household, business, entertainment, in the schedule of meal preparation, planning increased sales or more economic production, etc. As applied to highways, planning is a gathering of basic information and the study thereof to determine the needs for proposed or existing highways, the costs involved in the new construction, whether warranted or not, the types, costs, and uses of present highways, and whether these should be changed to meet modern methods of travel.

Generally, the activities of the Planning Survey, up to the present time, may be segregated into the following phases: (1) An inventory of the roads within the State, (2) preparation of new county and State maps as a result of the above inventory, (3) traffic studies, (4) a study

Section of reconstruction on U S 40 through Carlin Canyon.

of the financial set-up within the State, (5) aviation, and (6) special studies.

ROAD INVENTORY

One of the very first activities of the Nevada Highway Planning Survey was the formation of field parties and the logging by those parties of all public roads in the State. In logging these roads, bearings and distances were obtained, making it possible to properly map them; and, in addition, such other pertinent data were recorded as farms, schools, dwellings, mines, business establishments, streams, lakes, reservoirs, railroads, etc. Not only were the roads so logged that they could be mapped, but the mileages were determined by surface type and width, and also as to road system.

Planning survey records show that 23,398.9 miles of rural public roads existed in Nevada at the end of the calendar year 1939. This mileage includes all traversable roads which are open to public travel and are located outside of the limits of incorporated cities and of unincorporated urban compacts having a population of 1,000 or more.

The rural public roads are divided into three general administrative systems: The Federal Aid System; the State Highway System, which includes the Federal Aid System; and County Roads. A fourth system of Federal Aid Secondary Roads is now being selected from data collected by the Planning Survey. At the end of 1939 the mileage of rural public roads in each of the three general administrative systems was as follows:

Federal Aid System	2,038.5 miles
State Highway System	5,134.0 miles
County Roads	18,264.9 miles

A mileage chart depicts the rural mileage on the various administrative highway systems, and in graphical form shows the mileage on combinations of systems and the overlapping mileage on each. This chart is prepared as of December 31, 1937, the latest date for which all of this information is available, but there has been very little change in the relationship between traffic volume and road surface types since that time.

The U. S. Highway System is not an administrative system, but all of the Nevada U. S. highways are on the Improved State Highway System, with the exception of a section of approximately 18 miles in length on U S 6 in White Pine County from Sacramento Pass to the Utah State line. There are eight U. S. highway routes traversing the State. Table No. 28 gives the mileage on each Nevada U. S. highway route and shows the mileage where one numbered route overlaps another of lower number. The present nonoverlapping mileage of U. S. highways in the State is 2,293.8.

A system of strategic military highways in Nevada, all of which are on the U. S. Highway System, has been selected and approved by the War Department. The mileage in Nevada on this system consists of 1,445.5 rural miles and 26.2 miles within the limits of incorporated cities. The Planning Survey has devoted considerable time to furnishing the Public Roads Administration with detailed traffic figures and other Planning Survey data which show by means of charts the present condition of the strategic military highways.

The mileage of each general surface type on the State Highway System, as of December 31, 1937, classified by traffic volume groups, is shown in Chart No. 1.

These data, collected as of December 31, 1937, have been tabulated and charted during studies made in the 1939–1940 period. Road type and traffic volume relationship has changed but slightly in the past two years.

The general surface types of unsurfaced, gravel or stone, low type bituminous, and paved may be briefly described as follows:

Unsurfaced—All primitive, unimproved, and graded and drained roads which have not been surfaced with gravel or stone.

Gravel or stone—All graded and drained roads that have been surfaced with gravel or stone.

Low type bituminous—All gravel and stone roads that have been treated with bituminous material, including roadmix and plantmix bituminous surfaces.

Paved—All rigid types of pavements, consisting of Portland cement concrete, bituminous concrete, or higher types of surfaces.

The above chart for the rural State Highway System shows that most of the unsurfaced mileage serves a volume of traffic having less than an average annual 24 hour density of 10 vehicles per day, that the greater part of the low type bituminous surface mileage serves a volume of traffic of 50 to 200 vehicles per average annual day, and that the high type pavement serve a volume of traffic in excess of 900 vehicles per average annual day. The chart also shows that in 1937 there were 152 miles of unsurfaced roads and 133 miles of gravel and stone surfaced roads on the State Highway System which served an average annual daily volume of traffic of 50 or more vehicles, which is greater than the volume of traffic served by 268 miles of low type bituminous surfaces.

Data on mileage of each surface type on the State Highway System classified by age groups are being assembled in the Road Life Study but are not yet available. However, practically all of the improved surface on the State Highway System was constructed after the formation of the State Highway Department in 1917. Eighty percent of the surfaced mileage on the State Highway System in 1937 was of the mixed bituminous type, and the greater portion of this mileage was constructed in recent years. Most of the surfaced mileage which has been retired was retired because of obsolescence of roadway or of surface, or because of the increase in volume of traffic or in size and number of heavy trucks which made the surface inadequate, and not because the surface was worn out by the traffic for which it was designed.

MAPPING

When originally conceived, the mapping program of the Nevada Planning Department was to edit graphically the results of the field inventories of roads and culture conducted during 1936 and 1937 and thereby provide a basis for future highway planning. From the unusual interest shown by State and Federal agencies, private organizations and individuals it soon became evident that if properly constructed, these maps would satisfy a crying need for complete and

up-to-date maps of each county. Consequently, a good deal of attention was paid to showing the various political subdivisions in their proper position.

The United States System of Public Land Surveys having been extended throughout Nevada by the Federal Government, the township and section lines of all subdivided areas were plotted and, where of recent date and therefore reliable, were used for mapping control. By use of the few known ties between section corners and geodetic control, the relative positions of a few townships were established at infrequent intervals on the base sheets, and the plotting extended in all directions therefrom. Probably in no State in the West were there more apparently fraudulent and erroneous surveys than in Nevada, with the result that when the land grid was extended by the old record

East Ely overpass.

distances and bearings from the known control points, hiatuses, overlaps, and gross distortions appeared in the land grid. In some areas these distortions were of such magnitude as to make an intelligent picturization impossible.

One area in particular presenting many problems, a small crew was sent into the field for a short time in the early part of 1939 to make ties by triangulation from every net of iron post section corners in the area to existent U. S. Coast and Geodetic Survey and U. S. Geological Survey triangulation stations. Ties were also made from a number of old stone and wooden corners at vital points where large errors appeared in the land grid, and from a number of points along the highways and other roads. The three-point method was mainly used thus avoiding the necessity of ascending the high points where most of

the triangulation stations are located. From these ties the exact longitude and latitude of each point occupied was computed and the results plotted by geographic coordinates upon the Lambert Projection with which the base maps were laid out. The mapping was then extended from these points, and although many errors still appear in the land grid, they have been localized and greatly reduced. In tying to the iron post nets, a basic control has been established by which new land surveys may be accurately mapped without additional field work. The positions determined along the highways and roads were used to more accurately control the location of the highway surveys and the compass and odometer traverses. As the data gathered during this work have been reduced to resultant geographic positions (a universal reference datum), they may be used by many agencies on any map projection without further adjustment.

Naturally, the scope of such field work was very limited, neither the funds, time, nor personnel being available for extensive field work of this character. However, the U. S. Division of Grazing, having utilized the base maps as prepared by the Nevada Planning Department as a basis for their land use and ownership studies, and witnessing the results achieved by making the triangulation ties in the area mentioned, presented a proposal to participate in a cooperative program. Under this plan the Range Survey Camps located in nearly every part of the State were to locate and flag or otherwise mark the existent geographic stations and to locate and mark the iron post section corner nets, as well as other old corners found by their engineers. The Planning Department was to furnish one man, familiar with triangulation procedure, to make the actual ties and compute the resultant positions. In view of the many advantages to be gained by obtaining this information in this manner, the program was adopted and will be carried to a conclusion this year. Ties will also be made to highways, railroads and other important features. From time to time, as the base maps are revised and brought up-to-date, these data will be incorporated and should eventually result in a set of county maps which are substantially correct and will better meet the need for accurate and complete county maps.

A new phase of highway planning was introduced to the Department in 1940 by the use of aerial photographs for the purpose of studying routes and location problems. By locating ground points of known relation to one another on the aerial pictures and marking them thereon, a map of very reasonable accuracy can be constructed showing every detail embodied in the pictures. Because of its familiarity with securing geodetic control for mapping purposes, the securing of the necessary ground control for the pictures has been turned over to the Planning Department. The field work consists of taking a series of photographs into the field, identifying points on the ground which appear in the pictures, and marking these points on the pictures. The geodetic positions of these points are then determined by extending existing U. S. Coast and Geodetic Survey and Geological Survey control to them by triangulation. This method of mapping, at present limited to those areas already covered by aerial photographs taken by various Federal and private organizations, promises to be one of the

most interesting and useful in the development of our future highways.

At the close of the last biennium the Planning Survey had completed base maps of Clark and Douglas Counties, but approval of these had not yet been granted by the Public Roads Administration. Tracings of base maps of Esmeralda, Lyon, Mineral, and Washoe Counties were in process, and the base detail sheets of the remaining counties, with the exception of Nye, were practically ready for tracing.

Owing to the lack of sufficient accurate information relating to the

Long tangent and easy grades on U S 93 looking north through cedars toward Pony Springs.

General Land Office surveys in Nye County, it became necessary, as mentioned above, to send a party into the field to perform work in making triangulation ties to as many control points as possible. Fortunately, a large number of well-selected locations were tied by this

work, which occupied the greater part of a month, and after the necessary computations had been made, geodetic positions of the various control points for continuing the mapping of highways and land grid were determined. With this information obtained, the detail plotting was completed and ready for tracing in January of 1940.

Work progressed steadily on all the other maps, consisting of the base map series, the post road and school bus route series, the general highway series, and the traffic flow series. From the base series of county maps duplications were obtained, and the additional map information required for each of the other series was in turn applied. At the close of this biennium all county maps had been completed and approval given with the exception of the general highway and traffic flow series of the Nye County map. For these two latter series only, approval was lacking at the close of the biennium.

Using the data compiled in the various county maps, a new State base map was begun in September of 1939 and completed during the biennium. This map is drawn on a metal mounted sheet 42 x 66 inches and is drawn to the scale of eight miles to an inch. Requiring much care and tedious drafting work, it shows State boundaries, county boundaries, township boundaries, railroads, highways, streams, lakes, forest reserves, Indian reservations, game and bird refuges, principal towns, and other features necessary for drafting of the State Planning Survey map, as well as for the making of tracings required in producing the color plates for the official road map to be distributed in 1941.

TRAFFIC

The comprehensive State-wide traffic survey and study, started in April 1936, was continued for a period of one year. A tremendous mass of detailed information was obtained in the field at that time, and the results of the study have now been compiled and analyzed. The compilation and presentation of the large volume of traffic data which have been gathered by the Planning Survey involved a great amount of detailed work. Below are listed only a few of the operations necessary to present facts and conclusions obtained:

Traffic Narrative Report of 150 pages.

462 pages T tables.

23 pages Origin-Destination tables.

117 sheets (17 x 20) Loadometer tables.

189 sheets (17 x 20) Pit Scale tables.

Coding, punching and verifying approximately 100,000 tabulation cards.

Counting and classifying data on 478,000 vehicles observed in July counts.

Compilation of 9,525 traffic data cards for automatic recorders showing hourly, daily, and weekly volumes and daily percentages.

Analysis of traffic data on 12,467,286 vehicles up to June 30, 1940.

Although the detailed study which was made during the years 1936–1937 has been discontinued, sufficient information has been secured during the intervening time to permit revision of the pertinent information for the succeeding years up to the present time.

This information has been used in many ways in the determination

of construction and maintenance procedure. It serves as a basis for priority of construction, construction standards to conform to traffic volume, detour requirements during reconstruction periods, and many other facts which are necessary for efficient progress.

At the present time, stationary automatic traffic recorders are operating at twelve locations on the main primary and secondary routes in the State. Also, there are ten portable recorders, which are being operated at eighty-five locations. These portable recorders operate for one week, at three-month intervals, at each location. An average of the four counts thus taken gives a very accurate average daily traffic for the year. These recorders were used to obtain traffic volume in determining and selecting the F. A. S. system for the State.

Since 1922 the State Highway Department has been conducting an annual count, which has been taken in July of each year. In addition to continuing this count, a traffic enumeration in January was started in 1940. Since July traffic closely represents the peak for the year, and January approximates the lowest volume, an average of the two will give a more definite picture of the annual trends.

The following table will indicate the percentage of the various classes of vehicles as shown by the July and January counts on the primary and secondary systems for a two-year period:

Year	Percentage local passenger	Percentage commercial	Percentage foreign passenger
	PRIMARY—JULY		
1938	44.7	10.8	44.5
1939	37.4	10.8	51.8
	PRIMARY—JANUARY		
1940	44.5	23.7	31.8
	SECONDARY—JULY		
1938	68.4	13.3	18.3
1939	68.6	13.4	18.0
	AVERAGE OF JANUARY AND JULY COUNTS—PRIMARY		
1939	40.9	17.3	41.8

By taking an average of the increases shown by the July counts and automatic recorders for the period 1937 to June 30, 1940, results show the following increases:

1937 to 1938	5.69 percent
1938 to 1939	16.3 percent
1939 to 1940	4.5 percent

Since there was a 16.3 percent increase in traffic for the year 1939 over 1938, it can be seen by the above tables that most of the increase in 1939 was due to the larger number of foreign passenger cars, while both foreign passenger cars and commercial vehicles contributed to the 4.5 percent increase in 1940 over 1939.

There is anticipated, therefore, a total increase in the three-year period of 28.45 percent. This represents an increase in general travel for all types of vehicles. While the total volume has risen, it can

Reconstruction on U S 50 between Leeteville and Fallon of new high-speed safe design.

readily be seen that the percentage relationship between the various classes of vehicles remains substantially the same.

From the T tables which were compiled from data collected during the 1936–1937 year of field operations, it was found that all vehicles in the State traveled a total of 776,517.6 vehicle-miles per day on the rural roads of the State. This figure does not include municipal or urban compact areas. By applying the 28.45 percent increase in travel which was found to occur from 1936–1937 to 1940, a total daily vehicle mileage of 997,426.8 is obtained. This represents 364,060,782 vehicle-miles for the year. If this mileage were converted into trips around the world at the equator, it would require about 14,562 complete revolutions to amass this number of vehicle-miles.

Of the total vehicle-miles traveled in the State, 79.41 percent were on the primary and 20.59 percent were on the secondary system. It has been estimated that foreign vehicles will account for 279,800.8 vehicle-miles per day, or 102,127,292 miles in 1940. From gasoline consumption tables and other data gathered, it has been estimated that the tourist left approximately $2,815,495 in the State for automotive expense and supplies during the year ending June 30, 1940. It has been found from reliable sources that 20 percent of the tourist dollar goes toward automobile operation costs; therefore, it can be determined that the total tourist expenditure for all purposes in the State for the fiscal year 1940 will approximate $14,077,475.

For the purpose of indicating the comparative traffic densities at various points in the State, a traffic flow map, found in the appendix to this report, has been drawn, showing the traffic volumes on the U. S. routes in the State. The flow bands represent the volumes from a minimum traffic of 75 to a maximum of 3,400 vehicles per day.

This traffic flow map graphically and quickly indicates the areas in the State where the heavy traffic occurs, as well as the areas where the number of vehicles is rather small.

Chart No. 2 of the appendix shows the variation of traffic volumes by days of the week as indicated by the stationary automatic traffic recorders for the years 1938–1940, inclusive. The similarity of travel habits by days of the week for the three years should be noted.

Chart No. 3 shows the variation of traffic volume by months of the year as shown by the stationary automatic recorders for the years 1938–1940, inclusive. It should also be noted in this graph that the monthly volumes for each of the years are very similar.

Table No. 29 shows location and annual averages for each of the stationary automatic recorders for the years 1938, 1939, and 1940, with the total percentage increase by years.

Table No. 30 presents an analysis of the traffic survey costs for the period April 3, 1936, to June 30, 1940. This table shows the field and analysis cost for each of the various phases of the traffic survey, both as to total costs and expenditure per vehicle observed.

FINANCIAL

The financial section of the Planning Survey is charged with the gathering and compilation of data on four allied subjects: Fiscal, motor vehicle allocation, road use, and road life.

The fiscal survey deals with the levies, collections and disbursements

for highways, roads and city streets, by fiscal year for each of the taxing units within the State. Tables have been prepared to show the amounts received for highway or road purposes by type of impost. Disbursements are itemized to show expenditures for right-of-way, construction, maintenance, and bond interest and redemption by highway system.

The motor vehicle allocation studies cover the place of ownership (rural, urban, etc., by population groups) of the various types of vehicles. In addition to the above, information as to the annual mileage traveled, the year model of the vehicle, and the motor vehicle imposts paid by the owners of the various types of vehicles is gathered and tabulated.

The continuing phase of this study includes the compilation of monthly reports covering the various motor vehicle imposts. These reports are submitted to the Public Roads Administration and are used in the preparation of data on a Nation-wide basis. These data are also used locally to check the fluctuation in revenue of the various imposts.

The road use survey was included in the initial phase of the survey. This survey covered the use of the various highway systems and city streets by the motor vehicle owners in the various population groups within the State.

The road life survey includes a comprehensive study of the construction data on those highways included in the State Highway System. Upon the completion of the recording of these data, it will be possible to compile tables on mileages or costs on any one project, county, route, surface type, system and width, or any combination of these, and to determine average life expectancy of the various existing surface types.

The Public Roads Administration has been publishing annually data on State Highway Department receipts and expenditures, which have been furnished by the Department. In order to supplement this information, the annual collection of receipts, expenditures, and debt service of counties and cities for road and street purposes has been started. This information has not been available before, and it will round out the picture of the cost of highways, roads, and streets in Nevada, and the sources of funds for their support.

Several tables have been selected as being typical of the hundreds prepared from data gathered in connection with the above four phases of the financial survey.

AVIATION

In the absence of any department of State Government dealing with aviation, the Civil Aeronautics Authority requested that the basic study of public airports, as it pertains to service roads and their necessity, be amended to provide for the taking of an inventory of all airports, both active and potential, in the State. Because of the national defense needs, as evidenced in the request of the Civil Aeronautics Authority, the study was undertaken and a system of airports planned and submitted to the Authority. This now forms the basis of airport development in Nevada.

Much of the basic information of the Planning Survey was used in the plan, and necessitated only minor study and compilation to make it available and complete. The compilation was done by directed National

Youth Administration forces, and mapping data for some of the airports were furnished by the Works Projects Administration.

Some of the items of information secured for each field were: Name of airport; class; location; airline distance from center of city and post office; altitude; proximity to roads and highways; description of field; drainage; service facilities available and charges; public utilities; direction, width, length, and type soil of landing strips, runways, aprons, taxiways, etc.; hangars; administration and other buildings; obstructions; marking and identification; lighting; radio equipment; expenditures for permanent improvements; income; maintenance expenditures; fuel sold; aircraft movements; passengers carried; number of aircraft based at field, and many other items of general information.

Maps of the airports and landing fields are a part of the survey records.

Table No. 37, found in the appendix, gives the standards and specifications recommended by the Civil Aeronautics Authority for airports and landing fields.

SPECIAL STUDIES

The following discussions cover some of the various types of special studies being carried on from time to time by the planning section of the State Highway Department. Studies of a similar nature and other types of studies will, no doubt, be carried on in the future in various sections of the State, where conditions warrant.

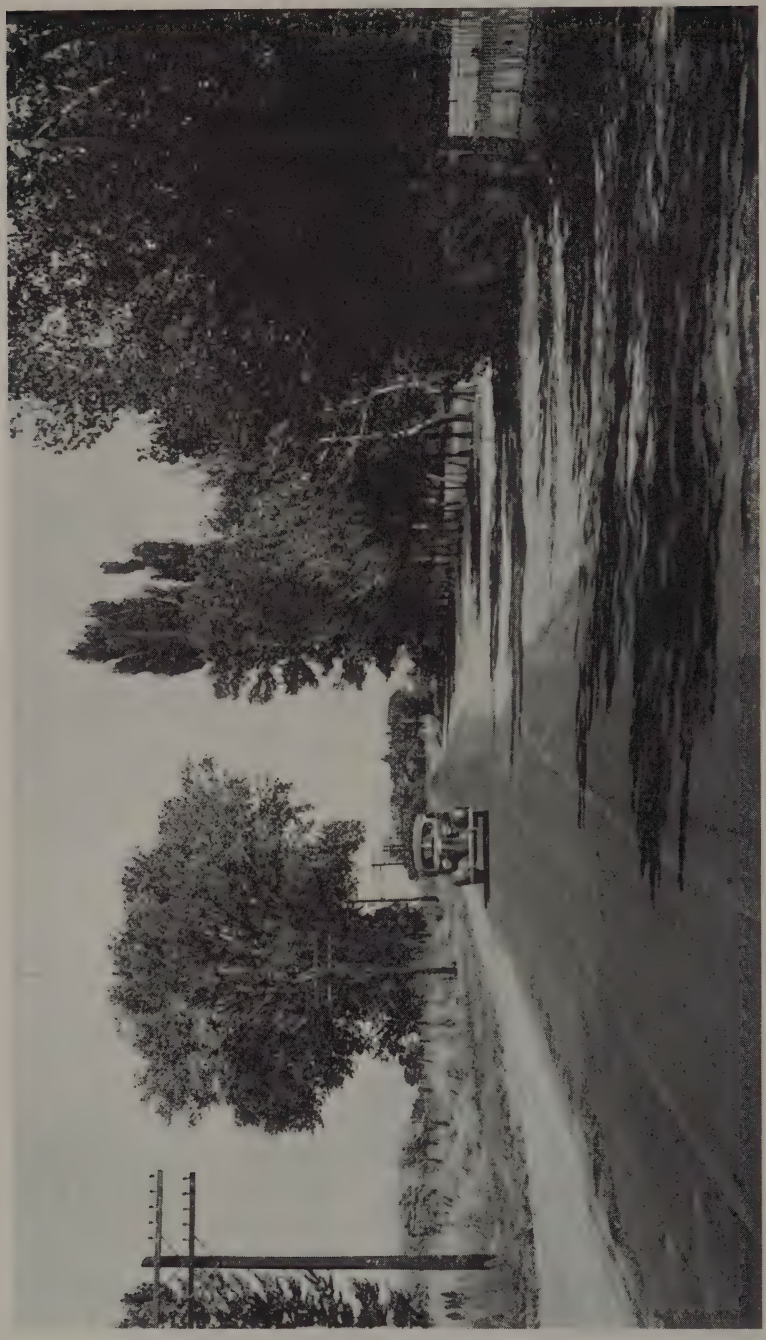
1. SPEED STUDIES ON LAKEVIEW AND WASHOE HILLS

Nearly every motorist, at one time or another, has been very vexed at having to remain behind a slow-moving truck going up a grade which had blind curves to discourage attempts at passing. The present-day desire to go some place in a hurry tends to exaggerate the actual time spent following slow-moving vehicles on steep grades; and as a result, in modern highway building, wherever the necessity actually exists, the trend is toward three or four lane roads on grades, to allow for passing at all times. This is especially true since the practice of striping roads to indicate restricted passing areas has been adopted.

Just such a condition exists on Lakeview and Washoe hills. There are maximum 6 percent grades and several zones are yellow-striped to indicate "no passing." This particular stretch of road between Reno and Carson City is one of the heaviest traveled roads in the State, there being an annual average traffic of about 1,525 cars per 24-hour day, the heaviest concentration of traffic existing during the daylight hours.

To obtain the results shown below, a two-man checking party counted all cars of all types passing various road sections on these two hills, and in addition timed as many cars as possible over a measured distance, giving preference to timing cars traveling up-grade. During the period of checking, a total of 4,529 cars were counted, traveling both directions, and speed checks were obtained on 3,142 of these, or on 69.4 percent of the total.

It was determined that 93.78 percent of all cars traveled at an average speed of 45 miles per hour. It was also determined that 2.64 percent of all cars traveled at an average of 15 miles per hour. The sum



Typical feeder road construction; scene near Fallon.

of these two percentages takes into account 96.42 percent of all the traffic, which leaves out of consideration only 3.58 percent of the traffic which travels between an average speed of 15 miles per hour and 45 miles per hour.

From actual measurements on the road it was determined that the total length of restricted sections, insofar as passing is concerned, in both directions on the Lakeview and Washoe hills is 3.13 miles. From the above information it has been calculated that the time lost by vehicles traveling over an average of 15 miles per hour, due to slower-moving vehicles, amounts to 18.7 seconds per car per trip through the territory in which these restricted passing sections are located. By expanding the time lost per car per trip into the actual number of cars traveling at an average of more than 15 miles per hour over these restricted passing sections, it is calculated that the actual time lost per 24-hour day for all traffic over this section of road amounts to 7 hours, 42 minutes, 30 seconds. This is based on a total traffic of 1,484 cars per day, traveling at an average of more than 15 miles per hour. The construction of a "slow lane" for the slower-moving trucks would be desirable when this section of road is reconstructed.

2. FEDERAL AID SECONDARY HIGHWAY SYSTEM

Since the original designation of what is known as the Federal Aid Primary Highway System was made, highway construction, with the aid of Federal funds, has proceeded at a rapid pace, until now the primary system has almost reached a stage of initial completion, although parts of this system are obsolete for modern high speed traffic.

The ideal highway as conceived in 1920 was a graveled road and amply satisfied the speed of traffic of that day, but when compared to the needs of modern speeds and traffic, the comparison becomes about as the 1920 road was to its dirt road predecessor—just obsolete. Modern traffic, even coming from the ranches, farms, and mining camps of the State, demands a hard-surfaced road.

Appropriations and construction had, until recently, been limited to a primary system of roads. The necessity of providing feeders to this primary system was recognized by the Federal Government when the Congress made a small allocation of moneys to a so-called secondary or feeder road system and ordered the survey to make a study and designation of a secondary system for the State.

This secondary system will represent a mileage equal to ten percent of the total mileage of the rural roads in the State. Due to the fact that Federal funds for construction of this secondary system have been, and probably will be for some time to come, inadequate to meet the demand, it is intended at this time to designate only a portion of the allowable mileage. One of the reasons governing this action is the fact that conditions may change over a period of years in connection with certain of these secondary roads to such an extent that if a full ten percent system were designated at this time, many of the roads now designated might not have the necessary qualifications or be needed when funds become available.

The formula for allocation of the secondary system to counties in Nevada, as first established by the Public Roads Administration, was

considered to be inadequate, insofar as the State of Nevada was concerned, and the Department requested and received permission to make the allocation to counties based on the following two factors:

1. The rural population of each county as a percentage of the total rural population of the State, in accordance with the following table based on the 1940 census:

County	County Population 1940	Deductions		Rural	
		Town	Population	Population	Percent
Churchill	5,317	Fallon	1,911	3,406	9.80
Clark	16,414	Las Vegas	8,422	4,408	12.69
		N. Las Vegas	1,053		
		Boulder City	2,531		
Douglas	2,056	Minden	288	1,139	3.28
		Gardnerville	629		
Elko	10,912	Elko	4,094	5,156	14.84
		Wells	830		
		Carlin	832		
Esmeralda	1,554	Goldfield	553	1,001	2.88
Eureka	1,361	Eureka	450	911	2.62
Humboldt	4,743	Winnemucca	2,485	2,258	6.50
Lander	1,745	Austin	580	797	2.30
		Battle Mountain	368		
Lincoln	4,130	Caliente	1,123	1,317	3.79
		Pioche	1,182		
		Panaca	508		
Lyon	4,076	Dayton	306	2,556	7.36
		Yerington	964		
		Fernley	250		
Mineral	2,342	Hawthorne	929	737	2.12
		Mina	376		
		Schurz	300		
Nye	3,606	Tonopah	2,465	991	2.85
		Beatty	150		
Ormsby	3,209	Carson City	2,478	531	1.53
		Stewart	200		
Pershing	2,713	Lovelock	1,294	1,419	4.09
Storey	1,216	Virginia City	948	268	0.77
Washoe	32,476	Wadsworth	212	5,285	15.21
		Reno	21,261		
		Sparks	5,318		
		Verdi	400		
White Pine	12,377	Ely	4,140	2,559	7.37
		McGill	2,464		
		East Ely	790		
		Ruth	1,921		
		Kimberly	503		
Totals	110,247		75,508	34,739	100.00

2. The rural vehicle-miles in each county (exclusive of the vehicle-miles on the Federal Aid Primary System, forest highways, etc., in each county) as a percentage of the total of such rural vehicle-miles of the State, in accordance with the following table, which is based on information obtained from the rural road inventory made by the planning section:

SUMMARY OF RURAL VEHICLE MILES BY COUNTIES

County	Secondary State		County		Total vehicle miles	Deductions for ineligible roads	Eligible vehicle miles	Percent
	Miles	Vehicle miles	Miles	Vehicle miles				
Churchill	56.3	652.2	836.0	10,390.1	11,042.3	435.7	10,606.6	7.53
Clark	134.9	6,683.8	1,057.5	13,338.5	20,022.3	6,651.6	13,370.7	9.49
Douglas	27.8	3,463.6	245.6	3,352.1	6,815.7	2,767.4	4,048.3	2.87
Elko	418.6	13,432.5	2,634.3	12,433.6	25,866.1	6,341.4	19,524.7	13.86
Esmeralda	92.7	2,289.0	711.1	4,284.9	6,573.9	175.2	6,398.7	4.54
Eureka	192.8	2,041.5	762.9	2,810.6	4,852.1	241.4	4,610.7	3.27
Humboldt	227.5	4,637.0	1,678.3	4,097.9	8,734.9	362.0	8,372.9	5.94
Lander	86.7	746.4	921.5	4,193.4	4,939.8	836.1	4,103.7	2.91
Lincoln	105.8	503.0	1,539.1	6,166.3	6,669.3	894.9	5,774.4	4.10
Lyon	113.8	7,322.8	606.0	7,052.6	14,375.4	1,763.5	12,611.9	8.95
Mineral	76.9	654.0	759.1	3,724.5	4,378.5	2,147.3	2,231.2	1.59
Nye	290.9	2,635.5	2,424.8	9,482.3	12,117.8	3,584.1	8,533.7	6.06
Ormsby	1.0	262.0	57.7	1,066.6	1,328.6	397.5	931.1	0.66
Pershing	176.8	1,839.6	1,563.6	4,187.4	6,027.0	.....	6,027.0	4.28
Storey	14.0	15.3	69.4	1,878.3	1,893.6	273.7	1,619.9	1.15
Washoe	283.0	8,953.8	924.5	14,573.6	23,527.4	4,826.9	18,700.5	13.28
White Pine	110.7	4,391.6	1,522.3	15,257.6	19,649.2	6,244.6	13,404.6	9.52
Totals	2,410.2	60,523.6	18,313.7	118,290.3	178,713.9	37,943.3	140,870.6	100.0

The above-mentioned factors are given equal weight, and in accordance therewith the following table shows the allowable secondary mileage for each county, based on a full ten percent system. In effect, however, only a portion of the system will be designated at this time in each county.

COUNTY DISTRIBUTION FEDERAL AID SECONDARY MILEAGE

County	Percentage by rural population	Percentage by rural vehicle miles	Average percentage	F. A. S. mileage	County No.
Churchill	9.80	7.53	8.665	173.3	1
Clark	12.69	9.49	11.09	221.8	2
Douglas	3.28	2.87	3.075	61.5	3
Elko	14.84	13.86	14.35	287.0	4
Esmeralda	2.88	4.54	3.71	74.2	5
Eureka	2.62	3.27	2.945	58.9	6
Humboldt	6.50	5.94	6.22	124.4	7
Lander	2.30	2.91	2.605	52.1	8
Lincoln	3.79	4.10	3.945	78.9	9
Lyon	7.36	8.95	8.155	163.1	10
Mineral	2.12	1.59	1.855	37.1	11
Nye	2.85	6.06	4.455	89.1	12
Ormsby	1.53	0.66	1.095	21.9	13
Pershing	4.09	4.28	4.185	83.7	14
Storey	0.77	1.15	0.96	19.2	15
Washoe	15.21	13.28	14.245	284.9	16
White Pine	7.37	9.52	8.445	168.9	17

The designating of only a portion of the allowable mileage at this time is further justified when it is realized that based on the present rate of appropriating funds for the secondary system, it will take approximately one hundred years to complete the ten percent system, or about fifty years to complete the mileage now being designated. It is hoped, of course, that as the primary system is gradually brought to modern standards, more funds will become available for the secondary system.

ORIGIN—DESTINATION STUDY IN THE RENO-SPARKS AREA

It is doubtful that anyone connected with the Federal Aid Highway legislation, passed in 1916, had any conception of what was to take place in the following twenty-four years. The automobile industry was in its infancy; the automobiles had the old-style high-pressure tires and were not particularly speedy; and mass production had not yet taken its place in the manufacture of cars. At that time a highway, as far as the West was concerned, was a winding trail over the desert, and there was not a single mile of surfaced rural road in this State.

From the original idea of a highway being a road between towns and cities, over which a person might travel in reasonable comfort and make an amazing speed of possibly twenty-five miles per hour, we have progressed until now highways are of necessity well-surfaced, designed for safety and speed, and in general far superior to anything anyone dreamed of in 1916. From the original purpose of merely providing a medium over which cars might travel from town to town and city to city, the highways now are used by fast passenger vehicles for both business and pleasure, by enormous trucks and trailers, weighing in excess of 35,000 pounds and traveling millions of miles annually, carrying on their business of transporting commodities of all kinds and providing speedy delivery service heretofore unheard of.

These changing conditions, as is always the case, have brought their

problems, which must be solved if we are to progress. One of these problems, which now is occupying the minds of men in highway work, has to do with the matter of the ever-increasing demand for saving time in traveling the highways and avoiding all possible delays brought about by having to follow a single, heavily traveled route through towns and cities.

Studies are being made in many places in the entire country to determine the necessity and desirability for possible alternate routes through communities whose streets are narrow and currently carrying heavy local traffic which impedes the progress of nonpaying through traffic. Another desirable feature of such alternate routes is the fact that they will make possible the designation of truck routes for diversion of heavy traffic which has no business in a particular community from streets normally used by local traffic.

The selection of highway routes based on the traffic needs of the people prevents discrimination against any part of a town by building alternate routes. The traveling public is demanding that it be given the opportunity, wherever possible and feasible, to save time by traveling alternate routes through or around towns in which it has no desire to go or in which it has no business to transact. The business man also subscribes to this thought, and there has already been some construction of such alternate routes through certain of our towns.

The origin-destination study in the Reno-Sparks area was undertaken with the thought of providing more means of entry to and exit from this area than exist at the present time, which in turn would relieve the heavy traffic congestion on the routes now used by through traffic in the area. The field work of the study was carried on during May and June of this year at four stations located on the four main routes leading into the area. Cars were stopped and drivers interviewed by being asked a number of questions, previously determined, pertinent to this particular study.

In this manner 4,762 interviews were obtained over a period of seven weeks. From these interviews much information was had relative to traffic origin and destination and other pertinent data.

The office analysis of this study has not as yet been completed, but no doubt, upon completion, it will bring to light many interesting facts. One question which was asked of all drivers of foreign cars concerned the length of stay in Nevada and the amount of money spent in the State. From the answers it will be possible to check, with some degree of accuracy, the estimates of expenditures made by tourists, per day, while in Nevada.

This same type of study will be carried on in other towns in the State as conditions develop to warrant such a study.

DESIGN—SURVEYS AND RECONNAISSANCE

Location surveys during the past biennium have, as in other similar periods, covered all types of highway construction and proposed construction, from resurveys of our most heavily traveled highway routes down to feeder road projects. The principal highway routes throughout the State have been constructed, with the primary routes, which

show the greatest density of traffic, being periodically reconstructed to a higher type of road to meet the demands as developed by increasing and changing traffic conditions.

Location work at the present time is far superior and entail considerable more work than that of a few years back. This is due to more elaborate roadway designs necessary to the ever-increasing traffic of all types, and to the safety of that traffic. It is practically impossible to construct a permanent road. All types, regardless of costs or materials, gradually deteriorate or changing traffic conditions render them obsolete. Although roads approaching the ideal can be constructed, costs are also prohibitive that but a few miles could be constructed each year. With the great amount of mileage which must have periodic reconstruction in order to satisfactorily serve the ever-changing traffic conditions,

Using stadia measurements on preliminary survey relocation at Mormon Mesa.

this method of highway construction is impractical. In addition to the reconstruction of our main highway arteries, it is necessary to reconstruct lesser traveled highways, though more infrequently, and also perform a certain amount of new construction when traffic conditions demands it.

Surveys are made for new construction on various designated highway routes when funds are available and there is sufficient traffic or potential traffic to justify such construction. Since 1936 there has been a special appropriation for the construction of feeder road projects. To date all feeder road surveys have been original locations for new construction. This phase of highway construction is comparatively new, to the extent that there has been no reconstruction of such projects, and probably will not be for some time to come, other than adding

an asphaltic surface to a previously constructed gravel surfaced road. On feeder road projects the higher type alignment is not so essential as on primary routes, and is rarely adopted unless the topography of the country is naturally adaptable to such alignment. Feeder road traffic is more or less local and considerably slower than that on main highway routes, and is satisfactorily served with any safe alignment on which reasonable construction costs can be had. Funds for feeder road construction are not in the amount to allow for any large scale construction programs. In 1936 this appropriation was newly created and considerable feeder road location was necessary to prepare for the expenditure of such funds. This largely accounts for the greater amount of feeder road surveys for the two previous biennial periods as compared to this biennium.

The greatest portion of survey work performed during the past biennium was relocation surveys for reconstruction on the primary highway routes. In the past few years the increase in traffic has been very rapid over these routes, necessitating higher type alignment and roadway design. Not only has an attempt been made to decrease the curvature and grades when reconstructing some of the older roads, but when surveying for new construction the same type of location, in keeping with present construction and maintenance costs, is now being adhered to.

On all relocation surveys of the primary routes an effort is being made to obtain a more or less permanent location on which any amount of improved roadway designs are adaptable without changing the location in general. This type of location will minimize old road scars and save practically all excavation work performed on any previous construction.

In order to accentuate the benefits derived from this type of alignment, relative to safety and permanency of the location, reference is made to a relocation survey during this past biennium on a mountain section of the Victory Highway, U S 40, over Immigrant Pass to Carlin, in Eureka and Elko Counties.

In referring to the following comparative data it is well to mention the fact that the old alignment as shown is a reconstruction and a considerable improvement over the old original location when gravel surfaced roads were in vogue.

	Mileage	Curvature	No. curves	Minimum radius	Speed design
Old alignment	16.28 mi.	2180°13′	57	300′	35 M.P.H.
New alignment	15.48 mi.	469°59′	15	2000′	70 M.P.H.

In anticipation of the preparation of plans for one year's construction program two survey parties are kept busy throughout the year. Under ordinary conditions a survey party will average about one-half mile of completed survey per working day. A completed survey includes several operations, such as staking center line, establishing bench marks and elevations along the line of survey, cross sections for excavation quantities, topography, property and section line ties. The progress of a survey depends to a great extent upon the nature of country, varying from alignment through city streets or towns to the other extreme of flat, open, desert land. Considerable variation is also found between the rate of survey over previously constructed roads

and that for new location. Occasionally construction parties are temporarily assigned to survey work, however, the bulk of location work is performed by the regular location parties.

The following table shows the total amount of surveyed mileage, segregated as to the various counties, completed during the last two biennial periods, 1936–1938 and 1938–1940. However, no attempt has been made to segregate this surveyed mileage into heavy or light construction projects.

County	Total Mileage of Surveys		Feeder Roads	
	July 1, 1936, to June 30, 1938	July 1, 1938, to June 30, 1940	July 1, 1936, to June 30, 1938	July 1, 1938, to June 30, 1940
Churchill	76.91	20.17	15.75	5.07
Clark	85.61	85.92	8.63	9.23
Douglas	20.13	21.13	17.88	
Elko	137.62	60.09	24.00	
Esmeralda	2.00	29.76		
Eureka	80.98	29.55	6.73	
Humboldt	54.91	15.81		3.00
Lander	27.35	62.04	17.33	
Lincoln	56.55	10.00	15.50	3.50
Lyon	8.02	47.42		
Mineral	22.44	5.00		
Nye	32.94	29.51		6.59
Ormsby	8.16	6.42		2.00
Pershing	54.88	39.56	13.15	3.00
Storey	5.97	6.41		
Washoe	31.90	17.45	20.67	13.32
White Pine	31.69	26.53		
Totals	*738.06	*512.77	139.64	45.71

Cost per mile of surveys, July 1, 1936, to June 30, 1938 ..... $190.86
Cost per mile of surveys, July 1, 1938, to June 30, 1940 ..... †208.25
*Total mileage includes feeder road surveys.
†Computed from total cost of all reconnaissance and surveys, $116,306.17 for the biennium.

In the foregoing tables the miles of surveys as listed include only the adopted mileage over which construction is contemplated, and excludes all alternate and other surveys sometimes necessary in determining the most feasible and economical location for construction, maintenance, etc.

However, the cost of alternate surveys, and surveys for obtaining special or additional data on various difficult sections, is included in the cost of surveys as shown in the tables. If only the expenditure of adopted mileage were used there would be an appreciable decrease in cost per mile. Preliminary and alternate surveys are necessary on certain projects and are a definite part of the ultimate survey costs, and therefore are prorated into the projects on which they occur, and included in the per mile cost and total costs of surveyed mileage for the biennium.

DESIGN—ROADWAY

Progress in the science of highway design is advancing rapidly year by year. A vast amount of research by the Highway Research Board, Public Roads Administration, various State Highway Departments and other organizations on the performance characteristic of vehicles, on the actions of drivers under diverse conditions and on the uses and qualities of the innumerable materials of reconstruction is enabling the Highway Engineer to more nearly fulfill the needs of traffic economically. This increase in the knowledge of general requirements, coupled with the specific data relative to the State of Nevada which

is being gathered by the Planning Survey, naturally leads to higher standards of design and construction. Work involved in the detailed study and design of a project has thus been increased, but the extra cost is being returned many fold in construction savings and in longer life and greater utility of the highway.

Visible changes in highway and bridge design are seldom radical; nevertheless they are steady, and a review of methods and results achieved during one biennium when compared with the preceding period reveals that a great deal of progress has been made. Improvements in any one design feature may not appear significant, but the total of all improvements is adding materially to the comfort, economy, safety, and enjoyment of the highway user. The more widely separated are the periods of comparison, the more noticeable, and even startling, become the differences. As an example, Figure No. 1 shows the typical cross section of an early construction project on the Victory Highway (U S 40) compared with the typical cross section of a newly reconstructed portion of the same route.

In the earlier years of the Department the major problem was to design and construct the greatest mileage possible with the limited funds available in order that at least the important highways of the State could be made possible. It was often necessary to design and construct to low standards to secure this result. With the improvement of a large portion of the primary highway system, the problem has changed on a relatively large part of the work to that of reconstructing existing facilities to provide adequate, safe, and economical transportation for increasing volumes of traffic.

In reconstruction every effort is being made to insure permanency of line insofar as future needs can be determined. Major features of permanency are the basic ones of grade, alignment and right-of-way width. Other factors such as surfacing are semipermanent, deteriorate with time and require constant maintenance and gradual replacement. Obsolescence, or failure to fulfill modern traffic requirements, has been the primary factor in making reconstruction necessary. Curves and grades and other factors which were satisfactory for traffic ten years ago no longer have a place in the modern highway.

Analyses of traffic over a period of years shows steadily increasing vehicle volumes and speeds. These trends projected into the future indicate that progressive improvement will be required to meet future traffic requirements. It is not economically feasible in reconstructing a highway to provide complete facilities for all anticipated future needs. To do so would entail too great an overdesign with consequent temporary idleness of a large investment, and it would also serve to decrease construction on mileage greatly in need of improvement. Neither is it desirable to design only for immediate needs, as this would result in rapid obsolescence and make reconstruction necessary before the full value of the original investment had been recovered, through use. An economical balance must then be reached by using a design which will fit the type and volume of traffic, the character of country traversed, and materials available, which will probably answer traffic needs during the life of the semipermanent construction items, and which will provide maximum salvage value when additional improvement becomes necessary.

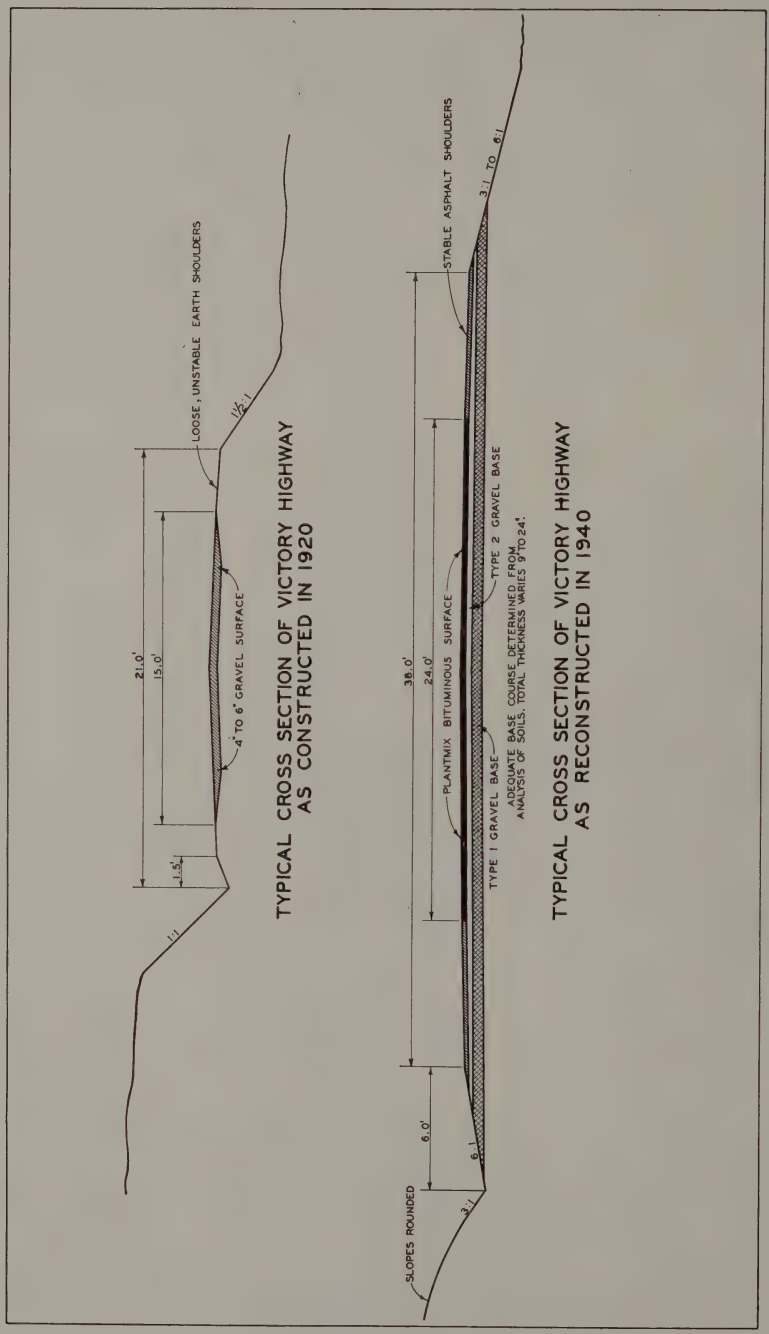

TYPICAL CROSS SECTION OF VICTORY HIGHWAY
AS CONSTRUCTED IN 1920
LOOSE, UNSTABLE EARTH SHOULDERS
1½:1
21.0'
15.0'
1.5'
4" TO 6" GRAVEL SURFACE
1:1
TYPICAL CROSS SECTION OF VICTORY HIGHWAY
AS RECONSTRUCTED IN 1940
STABLE ASPHALT SHOULDERS
3:1 TO 6:1
38.0'
24.0'
PLANTMIX BITUMINOUS SURFACE
TYPE 2 GRAVEL BASE
TYPE 1 GRAVEL BASE
ADEQUATE BASE COURSE, DETERMINED FROM
ANALYSIS OF SOILS. TOTAL THICKNESS VARIES 9" TO 24".
6:1
6.0'
3:1
SLOPES ROUNDED

FIGURE NO. 1

Recent advances in design include wider rights-of-way, wider pavements, wider shoulders, stabilized so that they are safe for use in emergency, use of higher type surfaces where traffic conditions warrant, a more extended use of flat fill slopes and cut slopes, construction of footpaths for protection of pedestrians, incorporation of landscape features in the general design, and many other items.

Obsolescence of highways is accomplished quickly by the development of adjacent lands, particularly through the establishment of small businesses abutting the right - of - way and requiring frequent access roads. A right-of-way width which may be adequate for construction requirements through sparcely settled areas soon becomes inadequate for highway speed traffic as the adjacent areas are developed. Since the rapid, safe movement of traffic is the primary function of a highway, and since improvement to property and establishment of businesses usually follows the construction of a highway, it has thus become

Long tangents, flat grades, wide roadways and treated shoulders provide high-speed transportation on desert sections such as this. This scene from Winnemucca east on U S 40.

necessary to secure wider rights-of-way to minimize, without discouraging, the effects of improvements to abutting properties and to preserve the public investment in the highway.

No traffic lanes less than ten feet in width are now being designed, and lanes of this width are being used only on minor roads with light traffic. On roads with a medium amount of traffic, a lane width of eleven feet is being used, while on major highways a lane width of twelve feet is the minimum. For ordinary two-way traffic this provides surface widths of twenty feet, twenty-two feet, and twenty- four feet, respectively.

On all heavily traveled roads, except in mountainous areas where cost is excessive, shoulders not less than seven feet in width are designed. These shoulders are stabilized either by roadmixing or by utilizing surfacing which has been salvaged from older projects and

which is primed and sealed with asphalt. Such shoulders provide nearly as good a driving surface as the pavement itself and are of sufficient width to permit parking without obstructing traffic lanes.

Practically all pavements now being placed on primary highways are intermediate type, or higher, the largest portion being plantmix asphalt. While relatively low in cost, this type of pavement is giving very satisfactory results. Greater control over the quality and proportioning of materials used in the pavement can be secured than was possible with the mixed-in-place type which it is replacing. Greater smoothness of riding surface together with a pavement texture which is highly skid resistant is resulting. The increased control of mate-

New long radius curve, wide roadway, long sight distance eliminates dangerous curve at Button Point on U S 40 east of Winnemucca.

rials is producing a more uniform product which is reducing the number of surface failures.

Flat side slopes, usually four on one or six on one are being used on shallower fills. These slopes permit a vehicle which has encountered difficulties to leave the roadway with a minimum possibility of overturning. On the higher fills where flat slopes would involve excessive expense, steeper slopes are being used, but the shoulder width is increased to partially compensate. Flat cut slopes are of material aid in reducing ordinary maintenance costs by minimizing erosion and frequent cleaning of side ditches. Natural vegetation reseeds itself more readily on such slopes, further reducing erosion and adding to the appearance of the improvement. Such slopes are also reducing costs for snow removal, reducing drift formation by controlling wind action.

On sections of highway in rural areas where foot traffic is expected,

footpaths are now designed so that pedestrians may have safe facilities equivalent to those provided for vehicles.

Pleasing appearance of the roadside has been found highly desirable. With little opportunity to successfully plant roadside areas, due to the arid climate in this State, it has become necessary to confine roadside improvement largely to eliminating the usual ugly features common to construction projects. Excellent results are being obtained through the use of flat cut and fill slopes, by treating these slopes in such manner that they will blend with the natural terrain, by avoiding disturbances of native growth wherever possible, and by a general cleanup of objectionable matter within the right of way. Each design is carefully studied and these features are included in the general plan. Handled in this manner the cost of the work is low and is more than repaid to savings in maintenance and increased satisfaction for the user.

DESIGN—BRIDGE AND GRADE SEPARATION STRUCTURES

The tendency in designing bridges is turning toward structures of more durability and of greater roadway width.

In the past a large portion of our bridges were built of timber, while in this biennium no timber structures were built. Timber bridges have been a cause of some maintenance expense which would not have been required had a steel or concrete bridge been built. The life of a timber bridge is not as long as that of the other types. In many cases the life of a structure is not so much dependent on the durability as on other features, such as location, vertical clearance, width and capacity, which cause structures to become obsolete. These features have been the cause of abandoning thirteen structures during the biennium. In addition four structures, in which the location and capacity have been satisfactory, have been widened to accommodate modern traffic. In studies of new locations, future development is a big factor.

The total cost of the fourteen structures constructed and the four structures widened was $334,261, which is for the structures only and does not include the cost of approaches. Four bridges and one overpass which have been built or are under construction, are of the continuous concrete slab span type supported on steel piles. Spans may be varied from twenty feet to thirty feet for this type. This type has proved to be quite economical, the cost varying from $3.60 to $4.25 per square foot. Previous to the use of this type, concrete and steel bridges have cost from $5 to $7 per square foot.

Two concrete arches of 100-foot span each were built over the Truckee River near Verdi. These replace the old arches which were abandoned because of location and their narrow roadway. These are the longest spans in the State. At East Ely the first rigid frame structure which was constructed by the Department was built. It is a steel structure spanning four tracks of the Nevada Northern Railroad with a span of 84 feet. The Glendale overpass is our first attempt to use a concrete span over a railroad. In this case there is no blast plate, but the concrete was thickened one inch on the bottom as a blast protection over the track.

The Rose Creek overpass is an example of the best alignment with

Carson River bridge west of Fallon on U S 50 widened to 26-foot roadway.

good sight distance. It eliminates the old structure with sharp curve approaches and narrow roadway, providing a crossing over the railroad on a tangent with easy grades and having a sight distance of 1,200 feet.

The new Apex underpass replaced an old structure which was narrow and a danger spot on U S 91. The new structure is also pleasing to look at, and its beauty has been increased by the planting of cactus gardens at each approach.

Our standard roadway width on bridges has now increased to 28 feet, or the pavement width plus four feet. We also use a two-foot sidewalk on each side. Three-foot sidewalks were tried, but where pedestrian traffic is not a controlling factor, it puts the curb a little too far away from the rail so there is more danger of a car hitting the curb. On short bridges we can now use a width between curbs equal to the shoulder width of the roadway. This was done on the two bridges near Carlin. On one of these we also tried using a metal guard rail in place of the regular bridge railing. The guard rails are lower and thus allow a better vision. The steel rail which was introduced during the last biennium has been adopted as a standard. It was discovered that the curved end-rail posts which are parallel to the roadway produce an optical illusion which makes the post appear to bend in toward the observer, no matter where he is in the roadway. To counteract this the posts are curved outward away from the roadway and thus present a more pleasing appearance.

RIGHT-OF-WAY

Recently we have been confronted with the problem of coordinating our Federal lands right-of-way acquisitions with the activities of the U. S. Division of Grazing. On January 15, 1940, notice was sent out by the Commissioner of Public Roads that hereafter all Federal land withdrawals for highway purposes under section 17 of the Federal Aid Highway Act (42 Stat. 212) will be referred to the Grazing Service for reports as to the effect the granting of such rights-of-way or material sites may have upon the administration of the area under the provisions of the Taylor Grazing Act of June 28, 1934 (48 Stat. 1269). Questions developing from this ruling, which affect the design and construction of the highways, and placed in the category of right-of-way concessions, are proper location of cattle underpasses, the fencing of the highway rights-of-way, the installation of cattle guards, gates and drift fences, the construction of fenced cattle driveways adjacent to highway rights-of-way, and free access by way of cattle underpasses to sources of water. Furthermore, the Highway Department has agreed with the Grazing Service to slope the resulting banks of material deposits withdrawn from public domain, in a manner that will afford free and safe access of livestock for stockwatering purposes.

A set-back policy adopted within the last biennium by the Highway Department has made expedient the procurement of an agreement, wherever possible and practicable, from property owners whose land adjoins any of the State highways, stipulating that no permanent structures will be erected within twelve feet of the exterior highway right-of-way lines. The primary purpose of such a stipulation is to

A long straight section on U S 93 between Pioche and Caliente; scene looking south toward Panaca.

prevent the use of the right-of-way for purposes connected with private enterprise such as service stations, lunch counters, and the like.

Before any State highway projects, constructed in whole or in part with Federal funds, are approved by the Public Roads Administration, acquisition of the necessary rights-of-way therefor must be guaranteed by the State Highway Department. The acquisition of rights-of-way for the construction of State highway projects is a State obligation; cost of the same must be paid entirely from the State funds. During the last year, however, Federal legislation has been enacted opening to the States the right to borrow funds from the Reconstruction Finance Corporation to be used in purchasing real property or interests in property necessary or desirable for road projects eligible for Federal aid under the Federal Highway Act. Such loans run for a long term at a fair rate of interest. There seems to be no present reason for availing ourselves of this Federal assistance, however, even here right-of-way costs have increased appreciably in the last decade.

During the past biennium, the department acquired 2,039.94 acres of private land at a cost of $28,970.47, or at the rate of $14.20 per acre. Acquisition of Government-owned land in the amount of 7,519.27 acres has been secured at no cost whatsoever to the State of Nevada. New maintenance sites acquired for the erection and enlargement of maintenance stations are listed in the table below.

See tables in appendix for listing of acreage and cost of land acquired for highway right-of-way.

MAINTENANCE SITES ACQUIRED JULY 1, 1938, TO JUNE 30, 1940

County	*Location*	*Type*	*Cost*
Clark	Las Vegas	5.46 acres	$3,500.00
Elko	Contact	20 lots	None
Elko	Battle Mountain	24 lots	500.00
Elko	North Fork	1.38 acres	15.00
Lyon	Yerington	0.25 acres	None
Lyon	Wellington	0.92 acres	25.00
Ormsby	Carson City	0.34 acres	None
Ormsby	Carson City	Portion street and alleys	None
Mineral	Mina	2 lots and buildings	740.00
Nye	Tonopah	1 lot and building	500.00
Nye	Tonopah	1 lot	200.00
Nye	Tonopah	Portion alley	None
White Pine	East Ely	36 lots	None
White Pine	East Ely	Portion alley	None

MATERIALS TESTING AND RESEARCH

Upon completion of the new laboratory in 1936, the Materials and Research Department was made one of the principal subdivisions of the State Highway Department, thus placing in it a position better to serve all phases of road building.

This department is charged with responsibility for investigating sources of supply, testing, inspection, and evaluation of all materials entering into the building and upkeep of highways, and reporting its findings and recommendations through proper channels. It is responsible, in cooperation with construction forces, for supervising the preparation, use, and field testing of materials during construction. It is also responsible for the training of personnel in material testing and

inspection procedures used in the field as well as those used in the laboratory, for introduction of improved testing equipment when necessary, to keep in close contact with important new testing developments and changes in specifications for materials and methods of testing.

Research projects must also be carried on from time to time. This is necessary because known specifications for materials and standard test procedures often do not touch a particular problem or do not supply all the desired information.

Services of the testing department are furnished principally to other branches of the Highway Department such as the departments of design and bridge, construction, maintenance, and the landscape architect. However, since the laboratory is the only one of its particular kind within the State, its services are also extended to branches of the State Government other than the Highway Department, and to certain U. S. Government agencies, to municipalities, and occasionally to manufacturing and construction firms and individuals. A nominal charge is usually made for services rendered organizations outside the Highway Department.

While a large variety of materials are tested, the bulk of the work, as can be seen by reference to tabulation, is concerned with physical and chemical tests of subgrade soils, roadway aggregates, materials for Portland cement concrete, and bituminous and metallic materials.

In order to perform the required preliminary investigations and tests before awarding a contract and to recheck and inspect all materials during construction, extensive work is necessary in both the field and laboratory.

The preliminary work consists of field and laboratory investigations of the subgrade over which the proposed road is to be built, and sources of supply of suitable aggregates. Two field crews from the materials department are at work throughout the year making these investigations.

The subgrade investigations are particularly important because that part of the design connected with establishment of the proper kinds and thickness of roadway reinforcing and wearing courses is dependent principally upon the laboratory findings.

Thorough prospecting and investigation of material deposits is very important from the standpoint of economy of construction and quality of the finished job. The contractor bidding on highway projects is enabled to know exactly where approved material is located and approximately how much is available. This definite knowledge results in a substantial saving due to the fact that the contractor can arrive at equitable unit bid prices rather than raising his figures to take care of what he would otherwise consider "the element of chance." Aggregates thus carefully prospected include gravels, select materials and stone for use in borrow-embankment, base courses, surfacing and wearing course, and concrete materials.

The construction phase of work carried on by the materials department consists in preliminary and final testing and inspection of all manufactured and processed materials, which includes rechecking of all aggregates, and close supervision of special operations such as the production and construction of plantmix surfacing.

While the laboratory is equipped to perform all required tests, certain material items such as timber, structural steel, and vitrified pipe which originate outside the State, must be tested or inspected at the source of supply prior to shipment. The services of an approved inspection agency are obtained for such work and it can be handled more economically in this manner.

At the time a project is ready for construction, the contractor, resident engineer, and division engineer are given notification listing the materials to be sampled and tested and those requiring preliminary inspection and are furnished instructions relative to proper procedure.

During the 1938–1939 biennium improvements were made in the laboratory quarters, several new pieces of equipment were added, and new test procedures were introduced.

In 1939–1940 a second story was built on the laboratory and connected with the main building in order to house other branches of the Highway Department. The landscape architect who was using a part of the laboratory floor moved to new quarters, thus allowing space for a private office for the testing engineer in the rear of the building. At the end of the biennium arrangements were made to partition off the rear room or stockroom to prepare a place for drying and quartering samples, thus eliminating the excessive heat and dust nuisance.

New equipment purchased during the biennium include a Wagner tubidimeter to determine the fineness of grinding of Portland cement, a Los Angeles abrasion machine for determining the wearing qualities of concrete and roadway aggregates, a sensitive torsion balance, a number of field compaction outfits, and a roughometer to measure the relative smoothness of the finished roadway surface. Minor improvements in testing equipment were made as follows: Building and installation of a small water heating unit to more accurately control the temperature in the moist closet, the improvement of vapor removal apparatus in the hood, improvement of swell testing and stabilization apparatus. Most of the improvements were made by forces of the machine shop of the equipment division in Reno.

The principal new testing procedure evolved during the biennium was for determination of the proper amounts of moisture and degree of compaction for all embankment materials. Since this is a test which must be performed in the field it has resulted in the necessity of bringing a number of field men in the laboratory for preliminary training in the use of testing apparatus and application of methods and test results.

Another new test procedure involving construction of Portland cement stabilized roads has been tried during the last year.

Subgrade investigation, tests, and methods of reporting were changed somewhat in an attempt to simplify the procedure by placing more emphasis upon the tests of principal significance and introducing a simplified soil profile for reporting the results.

Several research projects and special investigations have been carried on during the biennium. Cooperative projects have been undertaken with the cement reference laboratory of the Bureau of Standards, with the American Bitumuls Company, and with the Portland Cement Association. These projects include the testing of special cements, and investigations of special stabilizing materials. Working

Canal bridge west of Fallon on U S 50 widened to 26-foot roadway.

independently, the laboratory has completed or has under way the following projects: Study of applicability of various kinds of stabilization for fill material over salt marshes, study of density of subgrade in cut and fill sections, cause or failure of surfacing on old construction projects.

The tabulation which follows classifies and enumerates the various materials tested during the biennium. Field control tests, several thousand in number, are not included in the tabulation.

Metals—	
Reinforcing steel	362
Castings	3
Corrugated metal pipe	986
Wire mesh (reinforcing)	6
Copper seal and sheet	12
Sheet metal	1
Soils (Subgrade)—	
Physical and chemical tests	1,765
Surfacing Base and Fill Materials—	
Surfacing	430
Base	362
Borrow	266
Crushed rock	1
Plantmix	19
Binder	1
Screenings	9
Backfill	5
Concrete Materials—	
Portland cement	181
Fine aggregates	145
Coarse aggregates	143
Cylinders	2,566
Water for concrete	23
Mortar sand	13
Bituminous Materials—	
SC–1A	36
SC–2	541
SC–3	264
SC–4	39
SC–5	26
SC–6	51
MC–1	58
MC–2	98
MC–3	49
MC–4	15
MC–5	4
RC–2	102
Emulsified asphalt	13
Asphalt joint filler	5
Asphalt (water proofing)	6
Concrete primer	1
Chemical Analyses—	
Traffic lacquer	6
Read lead paint	17
White paint	75
Black paint	17
Aluminum paint	56
Blue paint	1
Turpentine and drier	1
Zinc oxide (paste)	3
White lead (paste)	3
Red lead (powder)	1
Steel	5
Cement	12
Silica	1
Copper	5
Bronze	1
Miscellaneous Materials—	
Creosote	5
Mineral filler	1
Tests for moisture (soils)	14
Expansion joint	32
Fire brick	1
Anti-freeze	4
Common brick	58
Barium sulfate	1
Specials (soils)	2
Aluminum silicate	3
Hollow tile (sidewalk filler)	6
Guard rail pipe	1
Asphalt saturated cotton	2
Building blocks	7
Roof flashing	1
Roof felt	1
Building tile	2
Transite water pipe	1
Stone for rubble	3
Rock for riprap	23
Building stone	2
Base rock for driveway	2
Key rock for driveway	3
Trash grates	1
Tests for stabilization	32
Extraction of bituminous mixtures including grading analyses	216

ROADSIDE IMPROVEMENT

Experience gained during the past biennium has led to a more simplified and standardized treatment of roadside improvement projects. Such treatment can be reduced to six basic considerations that are used in analyzing the problems of any project.

Roadside improvement on U S 93 near Las Vegas.

1. INSTALLATION OF NEW PLANT MATERIAL

This item has lately been confined to shade-tree planting of types that will do well under prevailing conditions in Nevada. The installation of evergreen and low shrubs and bushes has been discontinued, as installation and maintenance are costly, and material that lacks mass and height is not noticeable from cars passing at high speeds. Trees are being planted at or near irrigation ditches, canal crossings, bridge bulkheads and points of high water table to reduce maintenance expenditures.

2. INSTALLATION OF GROUND COVER

To stop erosion and improve the appearance of bare highway slopes several experiments have been made to determine a satisfactory ground cover. Native material has been transplanted, grass seeds have been broadcast, and native seeds have been gathered and spread. However, the best ground cover has been found to be native growth that voluntarily establishes itself along the roadway. It is natural in appearance and blends in well with the countryside. This phase of roadside improvement can never be entirely satisfactory because of the lack of adequate rainfall.

3. TOP SOILING AND SOIL PREPARATION

To assist as much as possible in the development of ground cover, poor soil conditions can be improved to catch and hold seed. Top soiling is usually confined to rocky or gravelly fill and back slopes. However, to top soil extensively would absorb all available funds. It has been found that if the plant material that does catch on bare slopes is permitted to remain and not bladed away, it will spread of its own accord, and mowing operations will keep it well under control.

4. LANDSCAPE GRADING

Landscape grading such as slope flattening and rounding of transition slopes is now handled in the original design for all new construction work, and very little additional treatment is required to induce rapid establishment of natural growth. On older construction projects this grading is done on sections where erosion or lack of plant growth shows it to be necessary.

5. OLD ALIGNMENT AND ROAD SCARS

When old highway construction alignment or road scars are visible from the roadway and they serve no useful purpose, the old roadbed or scar is scarified or otherwise treated to make it blend into the natural landscape. It is not always possible to eliminate large scars but the attempt is made to return as much of the landscape within the right-of-way to its natural state as possible.

6. REST AREAS AND SCENIC TURNOUTS

When proper scenic conditions prevail and a good site is available adjacent to the roadway, roadside parks and turnouts are occasionally constructed to serve both through and local traffic. These turnouts not only serve to give the traveler recreation and opportunity to enjoy scenery, but they serve safety in keeping traffic off the main traveled

highway when motorists will stop to rest or repair their automobiles.

A roadside improvement project takes into consideration all the above points to give a well-balanced program. To concentrate on one of the above phases to the point of eliminating others is to defeat the purposes of a well-rounded-out project and is not done unless conditions make it mandatory.

All projects are designed to extend over an appreciable mileage of the highway system so that developments are not confined to any one spot; the thought being to give a uniform treatment to as many miles possible with allocated funds.

All of the six items above mentioned have been used to good advantage during the biennial period in the planning and operation of roadside improvement projects. A substantial unit was placed in operation

Landscaping, bridge and overpass at Winnemucca.

at Winnemucca on the approaches to the bridge and overpass and along U S 50 between Fallon and Leeteville. The percentage of loss of trees and shrubbery on both projects was rather small but a study of the losses on these projects has led to the correction of the features involved, and losses of this kind should not occur again.

With the amendments to the regulations concerning roadside improvement permitting us a wider latitude of improvement, the work of this department should be simplified and made much more beneficial to the State.

OPERATION—TRAFFIC

The Nevada Department of Highways was one of the first in the West to establish a Division of Traffic Engineering and Accident Analysis in conformity with the views and recommendations advanced

by Thos. H. McDonald, Commissioner of Public Roads Administration in Washington, D. C.

With the organization of this separate section of departmental activity, certain definite duties and responsibilities were prescribed. Among these were:

1. Supervision of signing and marking of all highways throughout the State. This involves the purchase of all new signs and signing equipment, the construction of signs at the Reno plant, and full responsibility for the maintenance of all such devices in the field.

2. Cooperation with the maintenance division in a State-wide striping and marking program. (During the past year, the State of Nevada has adopted the national standard in the treatment of restricted or

Center striping unit constructed by the equipment division capable of painting three stripes simultaneously.

no-passing zones.) This is being carried on in conjunction with a greatly increased program of center-line striping.

In order to improve the striping methods in Nevada a new type paint machine was constructed at the Reno plant during the early months of 1940. This machine is capable of applying three lines simultaneously and, due to improved mechanical features, additional speed, etc., is superior to previous machines both from the standpoint of economic operation and actual results.

3. A sign and marking manual, depicting standard procedures, was completed and made available for distribution. This publication contains sketches, descriptions and instructions on the location and use

of all signs, signals, and markings in common use for the guidance and protection of the traveling public.

4. Another duty assigned to the division, and one which has gained immediate response throughout the State, is the setting up and sponsoring of driver-training and driver-education programs in the larger towns and communities. At present, classes have been established at Reno with the W. P. A. cooperating, and in the Elko high school, Las Vegas high school, and Sparks high school.

5. This division furnishes bulletins, texts and outlines dealing with safety observance regularly to schools and organizations throughout the State. Together with this, there is also available a file of traffic

Complete center striping unit.

and safety films which are used consistently in promoting safety among school children and adults.

6. This division gathers facts and information concerning motor vehicle accident occurrences on State highways in Nevada. In this field it is imperative to make monthly and yearly analysis of all reported roadway accidents and to submit this information to interested and cooperating agencies. The yearly report covers the twelve months preceding and, in addition to the written material contained in this report, there is prepared a number of illustrated graphs which clearly demonstrate the motor vehicle accident picture as it exists in the State of Nevada.

In signing activities we have taken the lead among western States in promoting the application and use of enlarged markers. These are designed chiefly to meet the demands of increased speed and to facilitate the movement of traffic at important intersections or junctions. It is also found advisable to treat certain hazardous locations with the oversized warning signs. These installations have resulted in a decrease of accidents at the particular point treated. This is also true of those localities where special pavement markings have been applied.

Considerable attention has also been given to improved methods of roadside delineation through the use of reflector buttons or other units which will return light from the oncoming vehicles. During the past two years, the department has installed some twenty thousand reflectors in marker posts along the main highways. The cost of such installations is nominal and the results as evidenced by the testimony of car operators, have been most favorable. Actual field observances indicate that the ordinary driver is better able to determine his position on the road at night if given some type of guide on the edge or shoulder of said highway. This is particularly true at that time when roadside objects are difficult to discern. In accompaniment with this type of illumination, field experiments are now being carried on in the effort to "light up" the center line. This has been accomplished in some States by the use of small glass beads imbedded in the lacquer. Such a test strip was applied in Nevada, although efforts are now being made to use native materials, silica base, and other minerals of luminous quality. Deposits of the latter exist in certain sections of Nevada.

SIGN DIVISION, BUDGET

During the past two years a total of $15,750 has been expended in erecting and modernizing signs and markers throughout the State. A recent survey indicates that there are 5,500 signs now in place along our highways at a total valuation of $39,800. These are distributed as follows.

	Number of signs	Total valuation
Division No. 1	765	$7,100
Division No. 2	1,601	13,900
Division No. 3	790	7,000
Division No. 4	625	5,800
Division No. 5	600	6,000
		$39,800

The actual number of signs placed in the field from July 1, 1938, to June 30, 1940, totaled 955. In addition to this, 321 cloth signs of various sizes (for temporary use) were distributed. As of June 30, 1940, there were 327 signs in stock at the Reno plant. These are kept on hand to serve any demand arising in the various divisions.

The charts which accompany this article portray the accident situation in Nevada over the past two years, and indicate (1) the violations involved, (2) the heavy accident locations by counties, and (3) the types of accidents.

OPERATION—PUBLICITY

Much favorable publicity for the State of Nevada was secured and sustained by the publicity division of the Department of Highways during the years 1938–1940.

Publication and distribution of NEVADA HIGHWAYS AND PARKS issuance of news releases for the press of the State, preparing feature articles for trade magazines of Nation-wide circulation, replying to thousands of post card and letter requests from individuals all over the world, distribution of a road condition report twice a month during heavy travel season, supplying material for Nation-wide radio broadcasts, furnishing many photographs for the National Tourist Bureau, a Government operated service, supplying photographs for

Painting two yellow and one white center stripe on a nonpassing zone.

magazines of national circulation, formulating and distributing informative material to many individuals who have made special requests, giving out information of road conditions, through personal contact, to hundreds of tourists who stopped at highway headquarters while passing through the city, obtaining information of an historical nature and supplying this material to prospective visitors in publication form, assembling and formulating road construction material for trade magazines together with photographs for illustrations, distributing of 50,000 official highway maps to the most strategic places, and securing additional publicity in various media concerning Nevada have comprised the endeavors of this section during the past biennium.

Publication and distribution of NEVADA HIGHWAYS AND PARKS, started in 1936, was continued during the biennium. General distribution of this magazine, issued bimonthly, has brought very gratifying results. Circulation figures have reached 30,000 copies for each issue and seemingly this number is inadequate to take care of the continuous demand, both by persons living outside the State and by Nevadans themselves who wish to mail copies to friends outside the State. As a result of this circulation of the magazine Nevada has benefited greatly. In addition to its promotion of tourist traffic and helping in bringing this industry up to record proportions, NEVADA HIGHWAYS AND PARKS through its informative material and its illustrations has broken down many of the prejudices against Nevada which still exist in many parts of the country. The favorable tax structure, the many outstanding scenic features, the industrial possibilities, the excellent highways, and the hospitality of Nevada citizens have been promoted through distribution of this magazine. From the favorable and complimentary expressions of opinion received through postal cards, letters, telegrams, and personal contact, NEVADA HIGHWAYS AND PARKS has, without a doubt, established itself as a dependable, authentic media of information benefiting any and all who are interested in the State. More than 85 percent of the 30,000 copies are distributed to persons, individuals, groups and associations living outside Nevada. Tourist agencies, automobile clubs, civic clubs, hundreds of schools and libraries, large department stores in eastern cities, service stations, tourist routing departments of nationally known oil companies, and kindred groups whose daily business relates to automobiling and touring have been, and are being, supplied with these magazines for the information and guidance of tourism. Direct results from this distribution can be noted.

NEVADA HIGHWAYS AND PARKS, normally a 16-page illustrated work, was enlarged during the early part of 1939 for two issues to meet conditions arising from the tremendous travel incident to the first year of the two World's Fairs, at New York and San Francisco. The March-April and the May-June numbers of 1939 were expanded to 32 pages each, fully illustrated, covering such subjects as the tax set-up of the State, excellent highways, sports features, scenic possibilities, mining opportunities, and a general outline of the history and industry of the State. Thirty thousand copies were printed of each issue and these were given wide distribution in the East as well as the West and other sections of the land. The purpose was to present a comprehensive picture of Nevada to prospective visitors to the fair and to induce travelers to include Nevada in their itineraries in either going or coming to and from the fairs.

Several issues were published having title pages printed in color, and these numbers were in unusual demand. Since the magazine started publication in 1936, more than half a million copies have been distributed.

Distribution includes some which go to foreign lands. Of all of the numbers issued since publication began there are now available, of any or all numbers, less than 50 copies; the remainder having been given judicious circulation. Some of the older numbers are extremely hard to obtain. Many persons have requested back numbers in order

to complete files for the purpose of engrossing them in book form, but these copies were not to be had and the Highway Department was unable to comply with these requests.

During 1939 six numbers were issued; in 1940 two numbers were issued up to July 31. From the many favorable comments made, in the press and by individual communication, there is no doubt that Nevada Highways and Parks has achieved its objective—the promotion of greater travel over Nevada highways.

Activities of an official nature having news value were formulated into press releases and served to all the newspapers of the State when the occasion arose during the past biennium. These releases included items of construction, maintenance, testing, planning survey, and a variety of other subjects.

Many feature articles concerning such subjects as highway construction, new construction methods, new projects under construction, bridges and underpasses, or some unusual feature involved in construction work peculiar to Nevada, have been prepared and mailed to numerous magazines which devote their pages to the field of highway construction and equipment manufacturing. In many cases these articles have been supplemented by photographs illustrating the various subjects covered. Service of this nature were given to several regularly issued magazines on the Pacific Coast, Chicago, New York, and Washington, D. C. Some of these articles were prepared in response to requests from the editors, while others were sent voluntarily to the publications. In nearly every instance these articles were accepted and used by the magazines concerned. News and feature articles concerning the progressive activities of the Nevada Department of Highways has been in demand by the trade magazines for Nevada's Department of Highways has gained a wide reputation for its progressive activities.

One of the main channels through which requests for information comes is the United States mail. Thousands of letters and postal cards have been received by the publicity section from firms, individuals and groups, seeking information of a highly varied nature. Most of these seek data regarding travel conditions in the State and want booklets, maps, stickers, and information showing scenic features, touring camps, conditions of roads and the best routings. Invariably the writers express the intention of visiting the State and wish to be preinformed. In many cases Nevada Highways and Parks is given for reference, and also a request for the current numbers.

During the late winter and early spring these requests come in greatly increased numbers. March, April, and May seem to be the peak months. During that time it is not at all unusual for the publicity section to receive, and give service, to more than 800 such requests in each of those months. All of these requests are promptly respected and given attention, no matter what the nature of the request. Through this activity much good will and prestige reflects upon the State. The practice is to send to each of the requestees a highway map and literature covering the special subjects indicated, as well as general information concerning Nevada and its scenic places and recreational areas. Many of these requests require considerable research to secure the

information desired, but every effort is made to secure and send such information to the prospective traveler.

Each year the Department of Highways publishes an official highway map of Nevada's road system which is intended for free general distribution. During 1939 there were 35,000 of these maps printed and sent out to groups and individuals, while during the spring of 1940 the number of these maps was increased to 50,000 to take care of the increased demand. These maps were prepared in the department's headquarters and upon printing were given distribution from that source. In the main, requests for maps come from tourist agencies, chambers of commerce, motor clubs, information desks in large hotels, and individuals who wish to have material of an informative nature to supply to their travel clients. Through this map, many hundreds of

Typical enlarged reflectorized signs used in many localities throughout the State.

travelers have been served and given directions for trips through the State over the arterial highways.

To meet a general and insistent demand for information concerning road conditions, projects under construction, detours and condition of detours, during the heavier part of the travel season, the section issues a "Road Condition Report" twice each month. This is an authentic report of all highways, and the construction progress thereon, for the benefit of the traveling public. So that these reports will more readily reach the traveling public they are sent to numerous places in all of the neighboring States. Practically every service station and tourist camp in our neighbor States are given a copy of this road condition report each time it is issued, on mimeographed sheets. By supplying service stations, automobile clubs, garages, oil company distributing

depots, and chambers of commerce in the nearby States, the good word about Nevada's highways can reach prospective tourists before they have been headed off in another direction because of the lack of such road condition reports. During the travel season, from March 15, to October 1, each year, more than 3,000 copies of this road condition report are sent out on each issue. All the information needed is contained on one 9 by 11 sheet of paper, which is mimeographed for economy, and the highway system map impressed on the reverse side. The various agencies to which these reports are directed have given, not only their cooperation, but have made many requests for additional copies of such reports to supply their customers.

The file of historic information concerning Nevada in the Highway Department is very extensive and is constantly growing. All material received is carefully checked and then preserved for future reference.

Radio programs of a Nation-wide character have been based upon information secured from this reservoir. "The Old Ranger" program, a national weekly broadcast, has had four of such programs during 1939 and 1940, to date, based upon data obtained from the information files of the publicity section. Other programs are expected to be developed from this same source. All of these programs were of a highly dramatic character, and treated of historic events surrounding Carson City and the early days of Nevada. Some personal incidents concerning the life and activity of Abraham Curry, founder of Carson City, were woven into highly dramatic sketches based upon facts obtained from the publicity section, and were intensely interesting.

Besides the Nation-wide programs already transmitted over the radio, much information has been supplied to the general headquarters of both National Broadcasting Company and Columbia Broadcasting System for their files, and much information has been supplied to the local transmitting station KOH.

Several years ago the National Government set up a bureau and inaugurated a service devoted entirely to tourism. Headquarters were established in New York, San Francisco, and Washington. The purpose of this bureau was to give authentic information to tourists concerning any and all of the States. Nevada has been well represented in these headquarters offices. At the request of the National Touring Bureau the Highway Department's publicity section forwarded to their headquarters many excellent photographs showing scenes of all kinds in all sections of the State. No portion of the State was omitted, and the photographs included scenes of mining, agriculture, scenic features, reclamation projects, ghost cities, stretches of highways and outstanding achievements of human culture such as Boulder Dam and the Liberty Copper Pit.

These photographs, we have been informed, have been put in an album and placed in a conspicuous place in the Tourist Bureau headquarters where public inspection can be had. Direct results have been more than gratifying. The Tourist Bureau cooperates most generously by forwarding to the Nevada Highway Department the requests from individuals and groups desiring additional information after they have viewed these photographs. Many hundreds of postal cards have come to the publicity section as a result of placing these photographs in the

Touring Bureau offices. Most of the cards indicate an intention of coming to the State, either for a vacation, or for the purpose of including the State on an itinerary to the west coast. The Bureau also prints a regularly issued pamphlet covering many phases of tourism and schedules of coming events in the States, and gives Nevada its share of publicity in this bulletin.

The publicity section has also sent numerous photographs to magazines having national circulation, to firms printing specialties, calendars, and other articles of an advertising nature, from which the State derives added favorable publicity.

Many individuals have sent requests by mail concerning many subjects, ranging from history to mining and prospecting, seeking detailed information on these subjects. Each request is given its proper attention and the service is always extended. This builds individual good will for our State.

During the summer season the Highway Department maintains an information desk, charged to the publicity section, to serve tourists passing through the city in various ways. Routing of travelers to national parks and outstanding scenic places, condition of roads, mileages, etc., is a part of this service. Many hundreds of personal contacts have thus been made at the Highway Headquarters and the information gladly given.

Civic and commercial bodies operating in the various communities throughout the State have been most generous in their cooperation in giving publicity to the State. They have supplied much information about their local communities to the publicity section. Rules and regulations concerning fishing and hunting, condition and location of tourist camps, data concerning mining, agriculture, and recreational facilities have been afforded by these organizations. The material so obtained has been very helpful in meeting requests which came to the publicity section through the mails or by personal contacts.

FINANCES—OPERATION

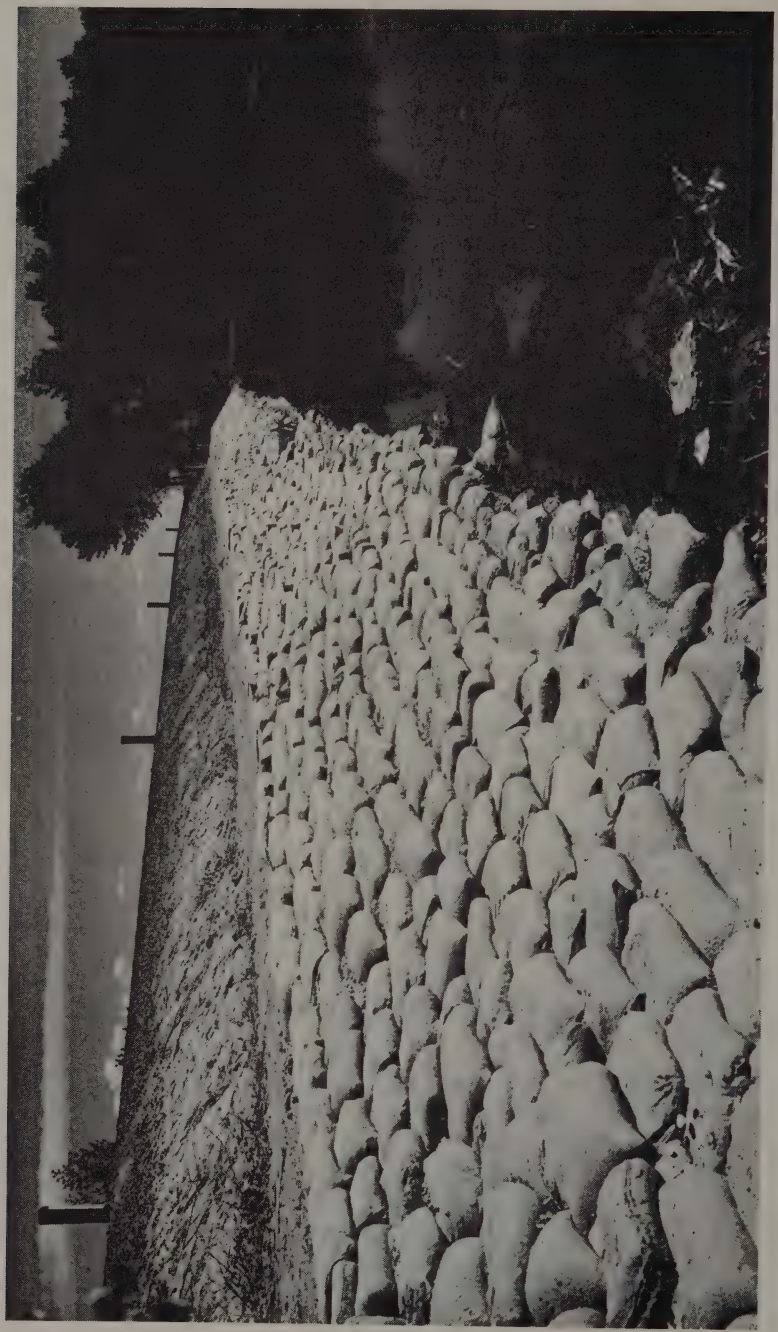
The financial tables for the biennium show a considerable decrease in receipts and disbursements over the previous two-year period. This decrease was due to the large reduction in Federal appropriations for highway construction.

All County-State highway bonds as authorized to be paid for from the State Highway Fund by chapter 81 of the 1929 Statutes have been redeemed.

As shown by State Highway Bond Redemption table, there remains only $150,000 of the total issue of $1,900,000 of bonds to be redeemed; $75,000 of these bonds to be redeemed July 1, 1940, and the remaining $75,000 on July 1, 1941.

The total amount of $600,000 advanced by the Federal Government and placed in trust account for payment of contractors estimates has been refunded to the United States Treasury. All payments to contractors are now made from the State Highway Fund.

In order to facilitate the compiling of reports and other statistics there was installed in the accounting department during the last year



Sacked cement riprap fill protection on Carson River near Fallon on U S 50.

a set of International Electric Business Machines. These machines consist of a duplicate key punch; duplicate summary punch; mechanical verifier; horizontal sorter and alphabetic accounting machine.

The system used with the machines is what is known as the punched card system.

All information desired is first coded on a numerical sequence basis; cards are then punched in accordance with the coding. After being punched the cards are checked against the original record for errors. They are then put through the sorting machine and sorted according to codes. Cards go through the sorter at the rate of 400 per minute.

Upon completion of the sorting process, the cards are put through the electric accounting machine which automatically compiles the data from the cards and at the same time prints the information on a report form. This machine operates at a speed of 80 cards per minute.

There are other phases of work of the highway department the machines are being used for, such as personal record of all employees, compiling of traffic survey, motor vehicle registration and other data for the planning survey department.

We are now in the process of making arrangements to have all checks issued by the highway department from its authorized revolving fund run through the machines.

The Social Security and State Welfare Old-Age Assistance Departments are also making use of the machines for compiling of their data. We charge these departments a rental on an hourly basis for use of the machines.

Tables showing receipts and disbursements for construction, maintenance and operation are appended.

FINANCES—MAINTENANCE OPERATIONS

The State of Nevada, for highway administrative purposes, is divided into five divisions with a division engineer in charge of each division.

The division engineers, cooperating with the maintenance engineer, are responsible for the proper upkeep of all roads which are on the State Highway System in their respective divisions.

A special effort is made to secure uniformity and standardization of maintenance methods and practices. Each year several meetings of the department heads and division engineers are held and maintenance problems are discussed for the purpose of securing uniformity of practice and a higher type of maintenance.

Inspections are made by a Public Roads Administration Engineer semiannually, and the State is required to maintain to Federal standards all roads which have received Federal aid in construction.

The maintenance budget is prepared in June of each year. Funds are set up in this budget for general maintenance, bridge maintenance, betterment work, and any administrative costs which may be charged against maintenance operations in each division for the ensuing fiscal year. No definite amount is allotted in this budget for snow removal or extraordinary maintenance due to floods, cloudbursts, etc., so an emergency reserve fund is set up to take care of this work.

During the past two years several new maintenance stations consisting of houses and garages have been constructed and the older stations

Landscaping at intersection of U S 91 and 93 with native plants.

renovated with maintenance funds. Springs have been developed to furnish water for domestic use, and in some isolated stations automatic electric plants have been installed.

The maintenance department, in cooperation with the safety division, has carried on a traffic center striping program on all of the main traveled highway routes. "No Passing" zones are being established on horizontal and vertical curves where sight distance is limited in order to insure maximum safety for the traveling public.

Each year, due to increased road mileage and a very decided increase in winter travel, the State is required to keep more miles of road clear of snow. Every effort is made by the maintenance crews in the different divisions to keep highways open and to be of aid to the winter motorist in any emergency. During the fiscal year ending June 30, 1940, snow removal operations for a mild winter amounted to $53,982.85.

At the close of the fiscal year ending June 30, 1938, 2,770.20 miles of road were being maintained, while at the close of this biennium the maintenance mileage was 2,908.48, showing an increase of maintenance operations over 138.28 miles of highway.

The appended tables show a complete record of all maintenance operations for this biennium and also other interesting information concerning maintenance operations during previous years.

DIVISION OPERATIONS

DIVISION NO. I

Division I enjoyed a productive and progressive biennium during the period of July 1, 1938, to June 30, 1940, with completion of 40 miles of roadmix; 25.23 miles of plantmix; one underpass; 1.64 miles of footpaths, and contracting for, with partial completion, of 5.35 miles of plantmix and an overpass structure. Few cloudbursts, and unusually light snowfall in the Charleston area during the biennium, allowed greater time for regular maintenance crews to operate constructively rather than engage in patrol duties and repairs.

Route 6 (U S 91) is rapidly being brought to a standard satisfactory to present needs and with the exception of the section between Crystal and Glendale, and upon completion of the current contract between Glendale and the Mormon Mesa, a continuous high type oiled shouldered road exists for a length of seventy-five miles, or 58 percent of the entire route.

Reconstruction from the California State line to Jean on Route 6 provided correction for a bad flood condition and should materially reduce the high accident rate on this section. An underpass on an alignment revision at Apex connecting with 12.62 miles of plantmix to the east, 5.35 miles of plantmix with an overhead structure crossing of the St. Thomas Branch of the U. P. R. R. near Glendale, and a footpath project 1.64 miles long in Mesquite constitutes other work on this route.

Four contracts during the biennium constructed Route 5 (U S 95) from its junction at Railroad Pass near Boulder City to three miles south of Searchlight, a distance of 39.05 miles. Approximately seventeen miles remain to finish the route in Nevada and this construction is contemplated for the winter.

Automatic grade crossing warning signals were installed at Railroad Pass on the U. P. R. R. branch line and at the Charleston Boulevard crossing of the U. P. R. R. main line.

Maintenance activities, other than ordinary, during the biennium consisted of extensive drainage improvements, oiling gravel shoulders, realignment and reconstruction of a short section five miles south of Lathrop Wells, and seal coating of approximately forty-five miles of surface.

At the Charleston Park station, new dwellings for the crew were constructed and a gas and oil house installed. All outlying stations of this type were equipped with Kohler electric plants which give the employees and their families all facilities offered in the larger towns.

The new standard barrier line method for controlling passing in

Widening roadbed, installing curbs and gutters, roadmix footpaths through Mesquite, U S 91.

zones of restricted sight distance was instituted in Division I, and has proven very satisfactory. A yellow line is used in conjunction with the regular white center-line stripe to denote where passing is and is not allowed. It is hoped that this innovation and the more comprehensive reflectorized signing program will reduce a too high accident record.

DIVISION NO. II

Construction and reconstruction work in Division No. II during the biennium has indeed improved many sections of our highways in alignment, grade, width, base and type of surfacing.

The reconstruction of a portion of U. S Route No. 50, in Churchill County, from 1½ miles west of Leeteville to Fallon, is one of the outstanding contracts in that two very narrow bridges were widened and several dangerous horizontal and vertical curves were eliminated. The

roadbed on this section is now thirty-eight feet from shoulder to shoulder, with twenty-two feet of plantmix surface, and eight feet of roadmix shoulders.

With the above contract completed in 1939, and one of similar design recently completed from Carson City to 7½ miles east, U. S. Route No. 50 is in very excellent traveling condition.

During the past two years construction work on U. S. Route No. 40 from the California-Nevada State line west of Verdi to Mill City in Pershing County was executed on the most dangerous sections. This construction work from one mile west of Verdi to Reno consisted of the elimination of many sharp curves, poor grade line, and the building of two new bridges.

Contracts have also been completed from the Lyon-Churchill County line to Lovelock, a distance of approximately forty-five miles. At present a section in Pershing County from Lee's Center to Humboldt House is under construction, a distance of nineteen miles.

Flashing light signals have been installed throughout this division at dangerous railroad crossings. Seven sets were installed within the city of Reno, and one set at each of these crossings: Hazen, Lahontan, Weeks, Panther, and Washoe City.

Several thousand feet of beam type guard rail has been erected on sharp curves and steep high fills by maintenance forces and contractors. This type of guard rail receives much favorable comment from the traveling public, inasmuch as it prevents many serious accidents.

Snow removal on the valley roads has not been difficult in the past two years due to light snowfall. Clear Creek grade to Lake Tahoe, a portion of U. S. Route No. 50, has been kept open the year around, thus maintaining normal communication and travel for the people who stay at Lake Tahoe during the winter months.

The Mt. Rose road has been kept open for recreational traffic as far as Grass Lake, near the summit of the grade, making it possible for winter sports enthusiasts to drive within a few minutes walking time of one of the best ski hills in the West.

Maintenance work on most highways is very similar with the main thought of keeping our highways in first-class condition at all times, and making them as safe as possible for the traveling public.

DIVISION NO. III

Division No. III, located in the northern part of Nevada, embraces the county of Humboldt and portions of the counties of Pershing, Lander, Eureka, and Elko. Four interstate routes enter the division, namely: Nevada-U S 40, U S 93, U S 95, and the Elko-Mountain City road which continues to a junction with Idaho-U S 30 at Mountain Home.

Nevada-U S 40 is the primary East and West route across the northern part of the State and conforms to the inter-regional system of highways and is of first priority for military needs. Of the 265 miles of U S 40 in this division, 55 miles have been completed to widened section (30 to 38 feet) with heavy base, plantmix asphalt surface, and wide shoulders; 210 miles are of older type of roadmix surface, 20

This structure over Nevada Northern Railroad at East Ely eliminates grade crossing on U S 50 where there have been several serious accidents.

feet wide, with narrow shoulders of earth or gravel. During the biennium fifteen projects were placed under contract at a cost of $1,100,000. The needs for this route are to reconstruct all of the 210 miles of older type to the standards of today.

Nevada-U S 93 has been completed to roadmix oil surface for a distance of 94 miles. This type should be satisfactory for several years.

Nevada-U S 95 has also been brought to satisfactory standards for present travel, and is roadmix oil surface from McDermitt to Winnemucca, a distance of 74 miles.

Nevada 11 and 43 traverse northern Elko County from Elko to Owyhee on the Nevada-Idaho State line for a distance of 100 miles. The 50-mile section from Elko to North Fork has been completed and roadmix surfaced. The section from North Fork to Patsville has been graded and surfaced with gravel or selected base. This section covers 30 miles. The portion from Patsville to the Idaho State line, about 20 miles in length, is of lower type.

Projects constructed off the main routes during the biennium were:

(1) Eighteen miles of roadmix surfaced feeder from U S 95 at Paradise Hill to Paradise Valley on Route Nevada 8B.

(2) On Route Nevada 8A, between Battle Mountain and Austin, 28 miles of graded and gravel surfaced highway were built.

(3) On Route Nevada 21, 6 miles of roadmix oil surface, including reinforced concrete bridge over the Humboldt River, were completed. This section extends from the town of Beowawe to Junction with U S 40.

(4) Four day labor projects for railroad grade crossing signals were completed by railroad forces under the grade-crossing program. Three of these signals were located in the city of Elko and the fourth on Route Nevada 18 between Golconda and Midas.

Statistical data on construction projects is given elsewhere in this report.

Maintenance work was continued in Division III under the direction of the division office at Elko. Force consisted of division engineer, maintenance superintendent, office manager, and stenographer.

Equipment was maintained by the Elko shop with force consisting of shop foreman, two senior mechanics, one junior mechanic, stock clerk, and night watchman.

Maintenance work was carried on under the direction of ten foremen with an average crew of twenty-five helpers. One carpenter was employed.

In addition to general maintenance, there was performed in Division III improvement work in the following amounts:

(1) Construction of maintenance stations at a cost of $12,500. This includes garage and dwelling at North Fork and garages at Battle Mountain and Contact.

(2) Reconditioning of oil surface at cost of approximately $23,000.

(3) Sealcoating oil surface at cost of $4,000.

(4) Placing of traffic centerline on U S 40 and portions of U S 93 and U S 95 at a cost of $8,000.

(5) Landscaping of maintenance sites was started during the spring of 1940. Planting of trees and shrubs was done at the Elko shop, the North Fork station, and the Orovada station.

In the foreground is new overpass over Southern Pacific Railroad at Shoshone constructed on new alignment. In the center foreground the old steel truss bridge over the Humboldt River is now replaced by new bridge. In right background is Dunphy overpass over Western Pacific Railroad on U S 40, 25 miles east of Battle Mountain.

Snow removal costs were below normal during the years 1938 to 1940; most of the cost being rentals for stand-by snow equipment and for sanding of icy roads.

New snow equipment consisted of one Snogo Rotary and one Roto Blade mounted on F. W. D. truck.

Traffic study was continued in conjunction with the Planning Survey by the use of two electric eyes and several portable traffic recorders. Manual counts of traffic were taken at several locations through the division in July 1938 and 1939.

DIVISION NO. IV

For the period July 1, 1938, to June 30, 1940, the following construction program was carried out in Division IV which consists of reconstruction of existing highways, new construction, and two large overpasses for grade separations.

The work including construction, reconstruction, roadmix surface, signal installation, grade separations and structure repairs was carried out at a cost of $710,932.84 as shown on page 75.

This construction work gave Division IV 100.12 miles of improved road which includes better alignment, extra width, increased thickness of bases, new surface and longer sight distance. Also, a grade crossing over the Nevada Northern Railway in East Ely was eliminated by means of a new concrete and steel overpass. An old overpass, which was too narrow and on poor alignment in Keystone Canyon, was replaced with a concrete and steel overpass on improved alignment and grade. One flashing light automatic railway signal was installed at the Central Ely railway crossing. This crossing has only two trains a day—the passenger and mail train which is in service between Ely and Cobre.

The increase in traffic, a demand for better and faster roads under our new safety standards, and the improvement of road conditions for snow removal have been the primary factor in the design and construction of the above projects.

Two sections of road are now outstanding in the interest of improvements made in grade and alignment—one is the section from Panaca Junction to Pioche and the second is Keystone Canyon from Keystone to Ely. The new alignment and heavy work done to make good alignment possible stands out in contrast with the old road that crosses and recrosses the present highway between the same control points.

General maintenance over the division, such as repair to roadway surface, shoulder repairs, culvert and waterway repairs, sign maintenance, bridge repairs and snow removal, was carried on with an average crew of 45 men. The number of employees varied from a low of 37 to a high of 62, additional help being needed in emergencies such as heavy snow removal, cloudbursts, and on specific and construction authorizations. This general maintenance work was carried on over the two-year period at a total cost of $209,354.94.

During the two-year period traffic stripe was placed on considerable road in Division IV. The sections from Keystone to Ely, through Ely, Ely to McGill, and from Caliente to Pioche has a continuous stripe. Center stripe was also placed on sections of poor visibility due to horizontal and vertical curves on all sections throughout the division.

Dangerous alignment on U S 50 has been corrected by heavy grading and construction of new overpass in the narrow canyon between Keystone and Ely. Note abandoned roadway right foreground.

Contract number	*Project number*	*County*	*Length*	*Type*	*Location*
528*	FA 6, 70 25A and B, FAGH 25B	White Pine	4.714	Roadmix, including concrete and steel overpass	Keystone to Ely
539	WPGM 70	White Pine	.....	Grade crossing signal	Ely cemetery crossing of the Nevada Northern Railway
544	FAP 94 B, C, D	White Pine	26.97	Roadmix surface	Lincoln-White Pine County line to the east foot of Connor's Pass
545	FAP 69 and 94 A	Lincoln	25.07	Roadmix surface	Pony Springs to Lincoln-White-Pine County line
552	FAP 77	White Pine	9.79	Reconstruction and roadmix surface	Ely to McGill
559	FAP 77(3) FAGH 77(4)	White Pine	0.85	New construction, including concrete and steel overpass	East Ely
563	FAP 85(3)	Lincoln	9.95	New construction and roadmix surface	½ mile north Panaca Junction to Pioche
570	FAP 70 (4), 77 (6), 107B (2), FAGH 77(5)	White Pine	2.47	Reconstruction, construction, and roadmix surface	Ely through East Ely
571	FLH 14A(1)	White Pine	14.93	New construction, gravel surface	5 miles east of east foot Connor's Pass to Sacramento Pass
576	FAP 85 (4)	Lincoln	9.95	Roadmix surface	½ mile north of Panaca Junction to Pioche
588	FAGH 25B(4)	White Pine	0.05	Overpass foundation	0.8 mile west of Ely
600†	FLH 14 A (2)	White Pine	20.31	Roadmix surface	East foot of Connor's Pass to Sacramento Pass

*Contract Number 528, Keystone to Ely, was 35 percent complete as of June 30, 1938, $152,403.15 worth of work being done during the twelfth biennial.

†Contract Number 600, roadmix from Junction U S 6 and 93 to Sacramento Pass was approximately 23 percent complete as of June 30, 1940, with $7,399.80 worth of work being done.

A sign program has been carried on continuously, consisting of maintenance of signs in place, new signing, and sign replacement. The entire division is well signed with warning and informational signs, with special emphasis placed on directional signs at all important junctions.

The following equipment is used in the division for general maintenance, oil work, snow removal, and transportation:

Seven 1½ ton trucks, four 2½ ton trucks, two 3 ton trucks, three 4 ton trucks, one 5 ton truck, two pickups, two sanders, three A. C. tractors, one Universal truck shovel, one oil distributor, three Motor Patrols, 2 equipped with Hargrave planers, three No. 8 Adams Pull graders, one Snogo, one roto blade plow, eleven "V" plows, thirteen blade plows.

A Mercury sedan, Hargrave 6″ disc planer, and an Austin Western Motor Patrol was the only new equipment purchased for the division

New modern maintenance station at North Fork

during the period July 1, 1938, to June 30, 1940. All equipment was kept repaired at both the Ely and Reno shops and has given good service. However, some of the equipment is becoming old, and replacements should be made as soon as possible.

Both the winters of 1938–1939 and 1939–1940 were mild and no trouble was experienced in keeping the roads open at all times. The heavy snow equipment, *i. e.*, Snogo and roto blade were used very little during the two winters.

During the year 1938–1939 the Becky Springs maintenance station was moved to a new site eight miles north of Magnuson's Ranch on White Pine 2 E-2. The total cost was $6,732.89. This move was made to place the station in a more favorable location for the section to be maintained.

A new shop and garage building, including space for repairs and storage, together with a large enclosed yard for State equipment, was

built in East Ely during the two-year period. A brick-tile office building together with furnishings was completed in connection with Division IV headquarters. This houses the Division and Assistant Division Engineer, Office Manager, Clerk and Nevada State Patrol. The improvements in East Ely now places the division office, shop and garage building and storage yard all together, with all maintenance crews for the Ely district working from one central point. Three asphaltic road oil storage tanks together with a portable heater and transfer pump housed in a small building is located on a side track of the Nevada Northern Railway Company about three blocks from the main yard and shop. This is the only State equipment or buildings not located in the central yard.

During the period, 251.93 miles of oilmix surface roads in Division IV were sealed with RC-2 and MC-2 asphaltic road oil. This work was done under specific authorization with State equipment, labor, and supervision. Also, 18.34 miles of oilmix surface roads were reconditioned under authorizations with State equipment, labor, and supervision. This work consists of "tearing up" the surface that has failed, in some cases adding additional oil, remixing, and relaying. In some extreme cases it is necessary to remove the surface and place additional base before relaying the surface.

At Eureka, Nevada, a bad grade sag due to the prior construction of the Eureka-Palisade Railroad was eliminated after the railroad had been abandoned and all tracks removed. This construction work was done with State equipment and forces. The resulting grade line is an improvement over the original constructed grade line from a viewpoint of safety and snow removal.

The removal or discouragement of weeds along our shoulders and slopes is a problem that requires considerable time and expense. At present the most satisfactory and economical method is to remove weeds with graders and drags. This is a slow and expensive method at best. It is, therefore, evident that some better method remains to be found for the control and removal of weeds along our highways.

DIVISION NO. V

The principal construction project in this division during the past two years was the construction and oiling on State Route 8A resulting in the oil surfaced highway from Tonopah to a point opposite Round Mountain. This road serves the mining communities of Manhattan and Round Mountain and the ranchers of Smoky Valley.

In addition to the usual maintenance operations, some $10,000 was expended during the late summer and fall of 1938 repairing cloudburst damage, most of which was on Route 3, south of Goldfield and on Route 47, near Silver Peak. Cloudburst damage during 1939 did not exceed $1,500, while that of 1940 to date has been about $200.

Some $4,000 was spent on betterment work in the vicinity of Walker Lake, principally for the protection of one fill where wave action had eroded the toe. This work consisted of widening the fill and protecting the toe with large boulders of from one to five tons in weight.

Some 18 miles of new road was built on State Route 23, between Luning and the Brucite Mine. Mineral and Nye Counties, the W. P. A.

and the Basic Ores Co., operators of the Brucite Mine, cooperated to some extent in this work. More work is being done on this route at the present time and the entire 32 miles will be completed and gravel surfaced by December 1. The Basic Ores Co. is cooperating in the work being done at the present time.

Thirty miles of new road was constructed on State Route 3A from junction with Route 15 six miles west of Coaldale, south into Fish Lake Valley. Some 22 miles of this road has been surfaced with pit-run gravel, and some five miles remain to be surfaced. Esmeralda County and the W. P. A. cooperated in this work.

Considerable betterment work was done on Route 3, near Beatty, between Beatty and Goldfield and between Goldfield and Tonopah. This work consisted of widening cuts and fills and improving drainage.

Rattlesnake Maintenance Station. A typical desert maintenance station, modern and up-to-date.

Some $7,000 was spent on betterment work on State Route 58A, between Beatty and Death Valley National Monument. This work consisted of the construction of ditches and dikes to protect the roadway, amounting to about 8,000 cubic yards and the placing of 5,300 square yards of grouted hand-laid riprap. The W. P. A. cooperated to some extent on this work.

Some two hundred miles of highway were seal-coated during the past two years.

New maintenance stations were constructed at Coaldale, on Route 3, and at Rattlesnake, on Route 4. For the Coaldale station two four-room houses were purchased from the Southern Pacific Railroad Company at Mina, moved the thirty miles to Coaldale, remodeled and

modernized, a new 24 x 40 garage building was constructed, a 1,500 watt automatic Kohler light plant was installed and connected to the well pump, giving the station electric lights and continuous water pressure.

For the Rattlesnake station the office building at the Tybo mine was purchased. This was a frame building 58 x 32 feet in size which was cut in two, moved the 20 miles to Rattlesnake, and made into two four-room modern houses. A 1,500 watt automatic light plant was installed at this station. Water for this station is piped from Rattlesnake spring, a distance of about 2,000 feet. This is a gravity line giving about thirty pounds pressure at the station.

Another maintenance station was constructed on State Route 8A at Willow Springs, 36 miles north of Tonopah. At present the buildings at this station consist of an old garage building and small frame house moved in from other stations. Water for this station is supplied by 8,300 feet of pipe line from Willow Springs, the grade of this line is such that a pressure of about 100 pounds is maintained at the station.

Additional ground was purchased at Tonopah to augment the yards for the division shop and a 24′ x 24′ one-story frame building constructed for the division office.

Ground was purchased in Beatty sufficient for a small maintenance station at that point. A garage building was moved from Sarcobatus to serve this station.

All maintenance stations are now enclosed with standard 6-foot fencing and have underground gasoline storage, except Beatty.

Maintenance equipment has been improved and increased by purchase of one ½-yard Northwest crawler mounted shovel, two 5-ton Walters trucks, several smaller trucks, and snow-fighting equipment has been increased with one Rightway rotary plow and two blade plows.

EQUIPMENT

The Equipment Division, since the last biennial report, has continued to improve its buildings, shop equipment, and shop facilities in every manner possible.

The electric wiring of the plant has been replaced to carry the increasing electric load necessary for efficient operation. The gasoline and oil service room was reconstructed and put under a separate roof from the plant proper and has lessened the fire hazard. A new heating plant for the heating of road oil, also under a separate roof, tends to lessen fire dangers, and the construction of a new watchman's quarters, located at the main gate of the plant, puts the watchman in a centrally located position and enables him to see the yard at all times. A lathe for the turning of Hargrave discs has been constructed, which turns the discs at less than half the previous cost.

A new highway striping unit was constructed, and the success of this unit may be judged by viewing the type of striping it has placed on the highways throughout the State.

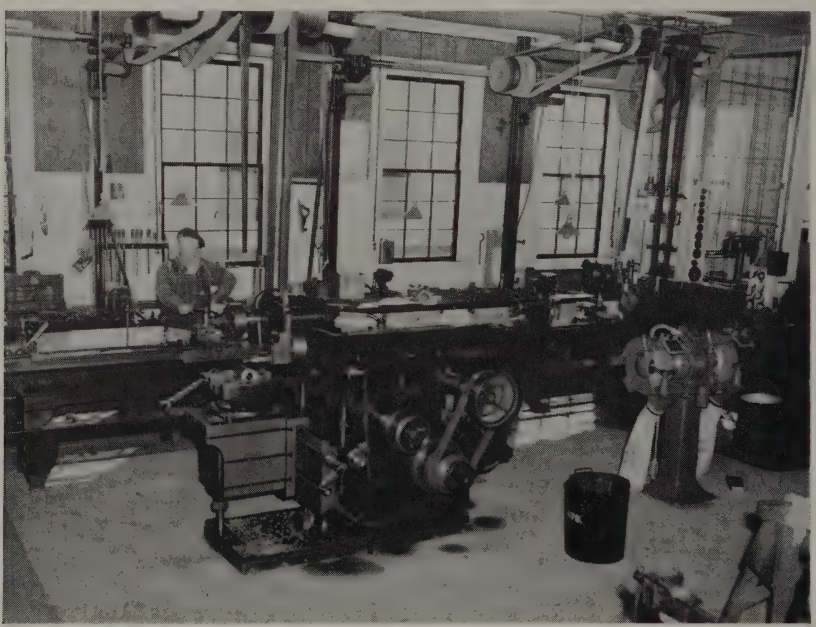
A core winder for road brooms has been changed over from a manually operated machine to a power operated one, which saves materially in both time and costs. In addition, the Reno plant has

successfully constructed a power-operated metal punch for the sign department which punches the holes for the reflectorized buttons now used in signing Nevada's highways.

The Equipment Division has purchased a light panel pickup, in which has been built a miniature shop on wheels, which travels over the State making repairs and servicing the equipment in the field. This traveling unit has proven itself to be of great value due to making repairs in time to prevent more serious damage, and enabling the equipment to be serviced at regular intervals.

In addition to the already-mentioned equipment constructed at the Equipment Division, three blade plows were constructed and one truck body.

The main equipment shops, being located outside of the city limits



Section of the up-to-date machine shop at the equipment plant in Reno.

of both Reno and Sparks, have of necessity been deprived of adequate sewage facilities, and this defect is now being remedied and a new system installed; also a long-needed improvement, the surfacing and proper drainage of the large storage yards at the plant will be completed this year.

This biennium has seen the replacement of the highway shops at Ely, which were destroyed by fire, and the erection of a new office building located on the same lot as the new shops.

The Highway Department has placed in service three Diesel Patrols, and three Diesel tractors. This is the first departure from gasoline-operated equipment, and the results are gratifying both in work done and in costs of maintenance. The Department has also retired most of

its heavy trucks and uses them for snow removal purposes, employing the lighter equipment for regular maintenance work.

The Equipment Division, during this biennium, has purchased 104 pieces of equipment, most of which were replacements, and the old units traded in on the new equipment.

Purchases were made in the following cities and towns of Nevada:

Battle Mountain, Carson City, Elko, Ely, Eureka, Fallon, Goldfield, Hawthorne, Las Vegas, Lovelock, Mina, Minden, Reno, Sparks, Tonopah, Winnemucca, and Yerington.

On the whole, the Equipment Division is very well equipped to supply any service necessary to maintain the equipment needed by the several Division Engineers.

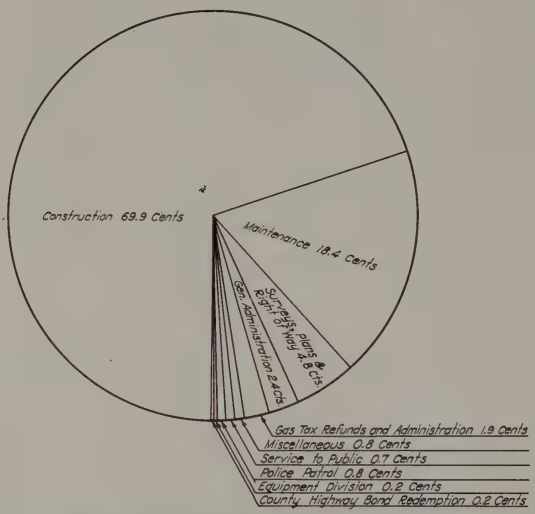
APPENDIX

TABLE NO. 1

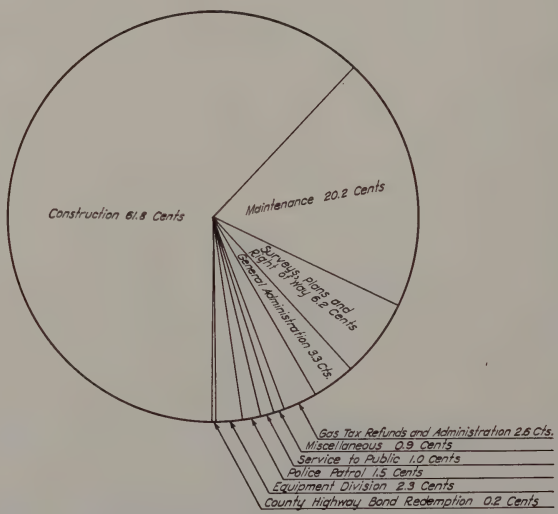
STATEMENT OF RECEIPTS

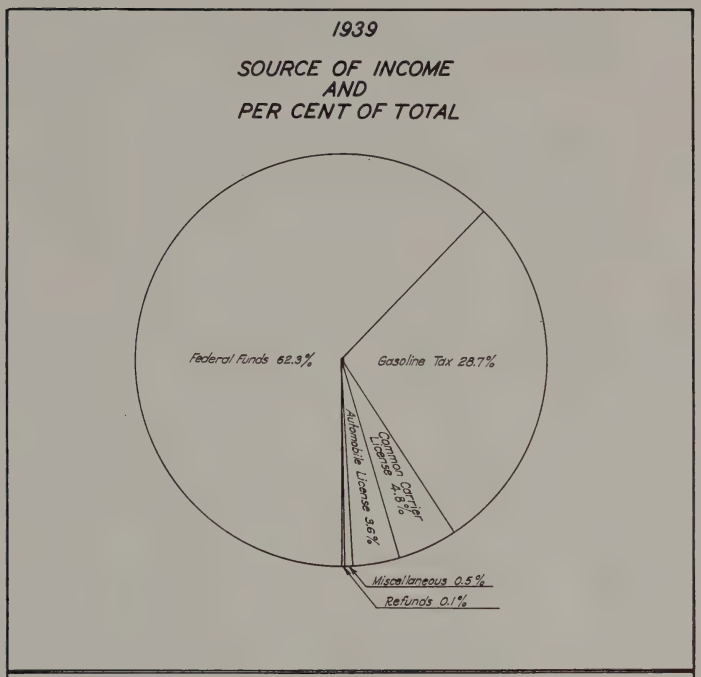
Classification	1917–1938	1939	1940	Total	Percentage
Legislative appropriation	$40,000.00	.....	.....	$40,000.00	.06
State tax levy	1,869,468.87	.....	.....	1,869,468.87	2.80
Auto license fees (net)	2,132,995.55	$166,349.35	$189,169.18	2,488,514.08	3.73
Gasoline and use fuel tax	9,273,251.57	1,320,501.96	1,509,892.75	12,103,646.28	18.12
Racing commission fees	147,428.86	.....	.....	147,428.86	.22
Common carrier license	1,156,069.45	218,745.42	258,811.45	1,633,626.32	2.45
Certificate of title	44,509.05	.....	.....	44,509.05	.07
Contractor's license	16,234.23	.....	.....	16,234.23	.02
Miscellaneous	750,832.89	24,475.66	48,694.82	824,003.37	1.23
State Highway bonds	1,900,000.00	.....	.....	1,900,000.00	2.84
Federal construction refunds	36,115,529.57	2,855,737.84	1,961,063.94	40,932,331.35	61.29
County construction refunds	4,095,940.35	1,100.00	10,082.95	4,107,123.30	6.15
County refunds on State maintenance	59,000.00	.....	.....	59,000.00	.09
County maintenance refunds	116,654.73	.....	.....	116,654.73	.17
Lincoln Highway Association construction refunds	71,426.60	.....	.....	71,426.60	.11
Utah-Nevada-California Association construction refunds	23,831.47	.....	.....	23,831.47	.04
San Francisco-Bay City construction refunds	25,000.00	.....	.....	25,000.00	.04
City construction refunds	212,553.41	.....	.....	212,553.41	.32
Railway crossing construction refunds	166,659.03	2,312.61	116.66	169,088.30	.25
	$58,217,385.63	$4,589,222.84	$3,977,831.75	$66,784,440.22	100.00
Advance to State by Government deposited in trust fund	600,000.00	.....	.....	600,000.00	
	$58,817,385.63	$4,589,222.84	$3,977,831.75	$67,384,440.22	

HOW YOUR HIGHWAY DOLLAR WAS SPENT
FISCAL YEAR 1939


Construction 69.9 Cents
Maintenance 18.4 Cents
Surveys, Plans & Right of Way 4.8 Cts.
Gen. Administration 2.4 Cts.
Gas Tax Refunds and Administration 1.9 Cents
Miscellaneous 0.8 Cents
Service to Public 0.7 Cents
Police Patrol 0.8 Cents
Equipment Division 0.2 Cents
County Highway Bond Redemption 0.2 Cents

HOW YOUR HIGHWAY DOLLAR WAS SPENT
FISCAL YEAR 1940


Construction 61.8 Cents
Maintenance 20.2 Cents
Surveys, Plans and Right of Way 8.2 Cents
General Administration 3.3 Cts.
Gas Tax Refunds and Administration 2.6 Cts.
Miscellaneous 0.9 Cents
Service to Public 1.0 Cents
Police Patrol 1.5 Cents
Equipment Division 2.3 Cents
County Highway Bond Redemption 0.2 Cents


1939
SOURCE OF INCOME
AND
PER CENT OF TOTAL
Federal Funds 62.3%
Gasoline Tax 28.7%
Common Carrier License 4.9%
Automobile License 3.6%
Miscellaneous 0.5%
Refunds 0.1%

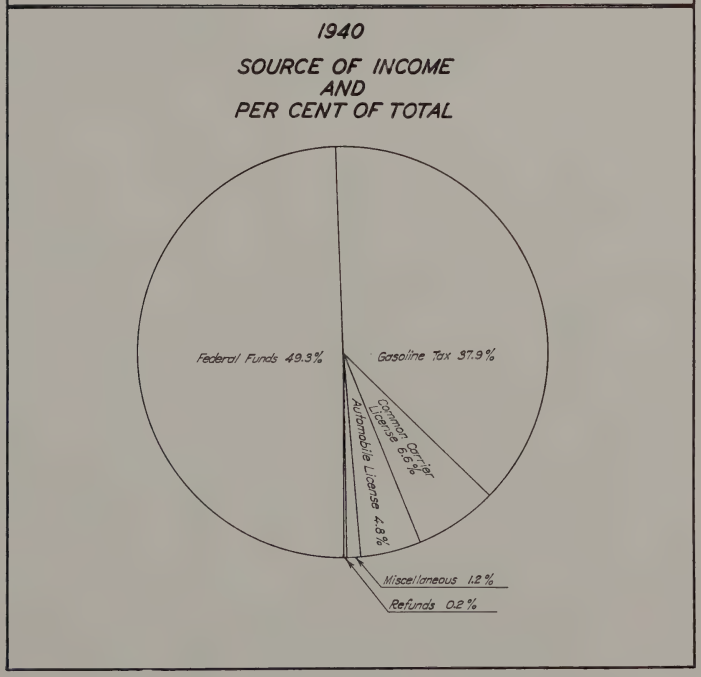

1940
SOURCE OF INCOME
AND
PER CENT OF TOTAL
Federal Funds 49.3%
Gasoline Tax 37.9%
Common Carrier License 6.6%
Automobile License 4.8%
Miscellaneous 1.2%
Refunds 0.2%

TABLE NO. 2

STATEMENT OF DISBURSEMENTS

Classification	1917–1938	1939	1940	Total	Percentage
Highway construction	$44,814,318.32	$3,164,717.90	$2,334,590.42	$50,313,626.64	75.33
Surveys, plans, rights-of-way and preliminary engineering	2,229,108.81	210,318.11	230,311.01	2,669,737.93	4.00
County maintenance	114,846.29	----------	----------	114,846.29	.17
Equipment division and plants	903,713.94	10,606.53	85,618.64	999,939.11	1.50
Accounts receivable	682,256.04	28,483.05	25,814.30	736,553.39	1.10
Section 31 refunds	40,107.17	----------	----------	40,107.17	.06
County highway bond redemption	216,896.65	8,305.02	6,966.34	232,168.01	.35
Laboratory building	21,642.18	----------	----------	21,642.18	.03
General administration	1,361,663.55	107,719.39	124,711.30	1,594,094.24	2.39
Highway bulletin and publicity	19,954.77	13,749.10	15,909.31	49,613.18	.07
Landscape architect department	----------	5,513.68	5,746.95	11,260.63	.02
Special highway traffic count	40,691.72	6,306.86	7,226.54	54,225.12	.08
Safety division	----------	13,756.44	12,745.94	26,502.38	.04
Sign division	----------	3,776.76	11,398.25	15,175.01	.02
Police patrol (highway)	247,127.49	20,647.50	41,151.06	308,926.05	.46
Public Service Commission deputies	53,694.98	11,959.51	11,672.99	77,327.48	.12
Common carrier and truck refunds	15,581.68	1,351.35	2,810.58	19,743.61	.03
Gas tax refunds	266,403.31	85,462.93	93,421.13	445,287.37	.67
Gas tax administration	11,713.49	2,657.89	2,695.62	17,067.00	.02
Use fuel tax administration	----------	----------	3,391.77	3,391.77	.01
Maintenance	7,444,388.20	830,877.69	763,075.33	9,038,341.22	13.53
	$58,484,108.59	$4,526,209.71	$3,779,257.48	$66,789,575.78	100.00
Transfer to revolving fund	22,452.02	----------	----------	22,452.02	
Transfer to U. S. Treasurer from trust fund	540,000.00	60,000.00	----------	600,000.00	
	$59,046,560.61	$4,586,209.71	$3,779,257.48	$67,412,027.80	

Reconcilement—		
Total disbursements	$67,412,027.80	
Total receipts	67,384,440.22	
Highway balance July 1, 1940	$27,587.58 overdraft	
Lists filed July 5, 1940, included in disbursements	330,533.52	
State Controller's balance Highway Fund July 1, 1940	$302,945.94	

TABLE NO. 3

STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR THE PERIOD JULY 1, 1938, TO JUNE 30, 1940

Receipts	1938	1939	Total	Per-centage
Federal aid	$2,855,737.84	$1,961,063.94	$4,816,801.78	56.22
County construction refunds	1,100.00	10,082.95	11,182.95	.13
Railway crossing construction refunds	2,312.61	116.66	2,429.27	.03
Miscellaneous	24,475.66	48,694.82	73,170.48	.86
Gasoline and use fuel tax	1,320,501.96	1,509.892.75	2,830,394.71	33.04
Auto license (net)	166,349.35	189,169.18	355,518.53	4.15
Common carrier license	218,745.42	258,811.45	477,556.87	5.57
	$4,589,222.84	$3,977,831.75	$8,567,054.59	100.00
Disbursements				
General administration	$107,719.39	$124,711.30	$232,430.69	2.80
Special highway traffic count	6,306.86	7,226.54	13,533.40	.16
County highway bond redemption	8,305.02	6,966.34	15,271.36	.18
Highway and parks bulletin	10,735.70	11,118.51	21,854.21	.26
Publicity and advertising	3,013.40	4,790.80	7,804.20	.09
Landscape and architect department	5,513.68	5,746.95	11,260.63	.14
Safety division	13,756.44	12,745.94	26,502.38	.32
Sign division	3,776.76	11,398.25	15,175.01	.18
Police patrol (highway)	20,647.50	41,151.06	61,798.56	.75
Public service commission deputies	11,959.51	11,672.99	23,632.50	.29
Common carrier and truck refunds	1,351.35	2,810.58	4,161.93	.05
Gas tax refunds	85,462.93	93,421.13	178,884.06	2.15
Gas tax administration	2,657.89	2,695.62	5,353.51	.06
Use fuel tax administration	.....	3,391.77	3,391.77	.04
Maintenance	830,877.69	763.075.33	1,593,953.02	19.19
Surveys, plans, rights of way, etc.	210,318.11	230,311.01	440,629.12	5.31
Equipment division and plants	10,606.53	85,618.64	96,225.17	1.16
Highway construction	3,164,717.90	2,334,590.42	5,499,308.32	66.21
Accounts receivable	28,483.05	25,814.30	54,297.35	.66
	$4,526,209.71	$3,779,257.48	$8,305,467.19	100.00
Transfer to U. S. Treasurer from trust fund	60,000.00	.....	60,000.00	
	$4,586,209.71	$3,779,257.48	$8,365,467.19	

TABLE NO. 4

FEDERAL AID ALLOTMENTS

1921	and prior	$3,527,276.18
1922		953,436.78
1923		635,624.52
1924		826,360.27
1925		947,623.25
1926		956,576.00
1927		948,318.00
1928		948,510.00
1929		957,995.00
1930	Regular	960,375.00
1930	Public lands	588,914.00
1931	Regular	1,601,408.00
1931	Unused portion Hawaii allotment	4,288.00
1931	Advance	904,961.83
1932	Regular	1,598,987.00
1932	Public lands	440,683.00
1933	Regular	1,421,688.63
1933	Emergency	1,575,756.00
1934	National Recovery	5,675,875.00
1935	National Recovery	2,844,481.00
1936	Regular	1,595,501.00
1936	Public lands	553,135.00
1936	Works Program, highway	2,243,074.00
1936	Works Program, grade crossing elimination	887,260.00
1937	Regular	1,593,978.00
1938	Regular	1,632,385.00
1938	Secondary highways	326,477.00
1938	Grade crossing elimination	250,000.00
1938	Public lands	560,201.00
1939	Regular	1,590,172.00
1939	Secondary highways	318,034.00
1939	Grade crossings	243,750.00
1939	Public lands	559,895.00
1940	Regular	1,275,938.00
1940	Secondary highways	191,391.00
1940	Grade crossings	97,500.00
1940	Public lands	212,442.00
1941	Regular	1,462,071.00
1941	Secondary highways	190,705.00
1941	Grade crossings	146,250.00
1941	Public lands	*218,031.00
		$44,467,327.46

*Appropriation for 1941 was $436,062, but only one-half allotted as of June 30, 1940.

TABLE NO. 5

STATEMENT OF COUNTY HIGHWAY BONDS

Principal and Interest Paid from State Highway Fund as Authorized by 1929 Statutes

Calendar year	Principal	Interest	Total
1929	$17,000.00	$4,521.65	$21,521.65
1930	18,000.00	7,407.00	25,407.00
1931	25,500.00	8,356.80	33,856.80
1932	25,500.00	6,935.55	32,435.55
1933	25,500.00	5,514.30	31,014.30
1934	23,500.00	4,093.05	27,593.05
1935	11,500.00	2,771.80	14,271.80
1936	11,500.00	2,140.55	13,640.55
1937	7,500.00	1,509.30	9,009.30
1938	7,500.00	1,078.05	8,578.05
1939	7,500.00	373.62	7,873.62
1940	7,500.00	*533.66	6,966.34
	$188,000.00	$44,168.01	$232,168.01

*Credit of $533.66 on interest paid in 1940 is to offset interest payments to Lyon County.

Counties in Which Bonds Were Paid

County	Bonds issued	Interest	Total
Churchill	$53,000.00	$11,280.00	$64,280.00
Douglas	32,000.00	6,241.65	38,241.65
Eureka	28,000.00	3,950.00	31,950.00
Lyon	75,000.00	22,696.36	97,696.36
	$188,000.00	$44,168.01	$232,168.01

ESTIMATED BOND REDEMPTION, STATE HIGHWAY BONDS

Principal and Interest Paid from Motor Vehicle License Fees

Year	Redemption of principal each year	Interest payments	Estimated license receipts	Estimated balance receipts
1920	$90,000.00	$654.15	$103,758.58	
1921	100,000.00	29,126.99	102,410.32	
1922	60,000.00	17,920.48	120,944.38	$29,411.66
1923		42,660.00	153,888.10	111,228.10
1924		25,640.00	181,969.85	156,329.85
1925	50,000.00	32,569.40	209,231.02	126,661.62
1926	100,000.00	31,750.00	209,919.71	78,169.71
1927	100,000.00	30,097.22	229,839.32	99,742.10
1928	100,000.00	28,814.59	249,110.62	120,296.03
1929	150,000.00	23,972.22	296,530.03	122,557.81
1930	150,000.00	16,056.25	330,222.25	164,166.00
1931	150,000.00	14,487.50	333,131.49	168,643.99
1932	100,000.00	20,127.60	332,973.00	212,845.40
1933	150,000.00	25,250.00	299,617.00	124,367.00
1934	100,000.00	19,750.00	246,828.00	127,078.00
1935	50,000.00	16,500.00	263,511.00	197,011.00
1936	75,000.00	13,781.25	279,429.00	190,647.75
1937	75,000.00	10,631.94	294,592.00	208,960.06
1938	75,000.00	9,868.05	266,611.00	181,742.95
1939	75,000.00	8,875.00	285,709.00	201,834.00
1940	75,000.00	4,125.00	275,000.00	195,875.00
1941	75,000.00	1,312.50	275,000.00	198,687.50

Total bonds authorized	$1,900,000.00
Total bonds issued	1,900,000.00
Total bonds redeemed	1,750,000.00
Total bonds to be redeemed	150,000.00

TABLE NO. 6

MAINTENANCE COSTS FROM 1918 TO 1940

	Mileage			Mileage	
1918	----------	$16,596.54	1930	1,905.43	$500,752.46
1919	----------	29,330.21	1931*	2,061.34	301,166.64
1920	----------	44,323.34	1932	2,113.02	618,377.41
1921	----------	33,601.26	1933	2,151.64	566,845.41
1922	----------	61,997.55	1934	2,287.37	502,715.66
1923	442.98	110,724.87	1935	2,524.77	617,784.47
1924	765.23	122,788.60	1936	2,656.68	675,726.06
1925	903.90	215,168.70	1937	2,697.82	846,033.35
1926	1,213.43	306,899.52	1938	2,770.20	756,305.26
1927	1,445.08	343,399.28	1939	2,805.90	830,877.69
1928	1,680.73	359,262.08	1940	2,908.48	763,075.33
1929	1,875.16	418,065.08			

*Seven months' expenditures, December 1, 1930, to June 30, 1931. Starting during the fiscal year 1933 and continuing through 1934, the maintenance crews worked and were paid for five days a week only.

TABLE NO. 7

SNOW REMOVAL COSTS, *1923–1940

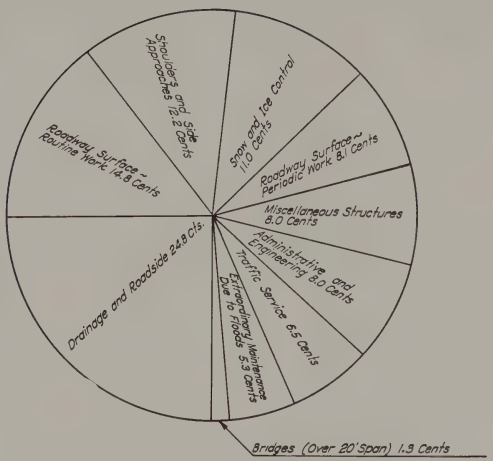
1923	$12,695.38	1932	$83,632.96
1924	884.53	1933	83,497.61
1925	1,479.13	1934	8,227.13
1926	1,803.43	1935	28,573.76
1927	8,228.95	1936	50,948.37
1928	3,167.50	1937	131,066.03
1929	16,172.05	1938	59,468.88
1930	19,466.28	1939	71,681.97
1931	4,711.45	1940	42,403.61

*Snow removal costs prior to 1923 not available.

MAINTENANCE REPORT FOR THE FISCAL YEAR JULY 1, 1938, TO JUNE 30, 1939

During the State's fiscal year ending June 30, 1939, the Department of Highways spent $830,877.69 for maintaining 2,805.90 miles of highway. The total mileage includes improved and unimproved types of road, and the total cost includes all direct and indirect charges to maintenance.

HOW YOUR MAINTENANCE DOLLAR WAS SPENT
FISCAL YEAR 1939


Shoulders and Side Approaches 12.2 Cents
Snow and Ice Control 11.0 Cents
Roadway Surface — Periodic Work 8.1 Cents
Miscellaneous Structures 8.0 Cents
Administrative and Engineering 8.0 Cents
Traffic Service 6.5 Cents
Extraordinary Maintenance Due to Floods 5.3 Cents
Bridges (Over 20' Span) 1.3 Cents
Drainage and Roadside 24.6 Cts.
Roadway Surface — Routine Work 14.9 Cents

HOW YOUR MAINTENANCE DOLLAR WAS SPENT
FISCAL YEAR 1940

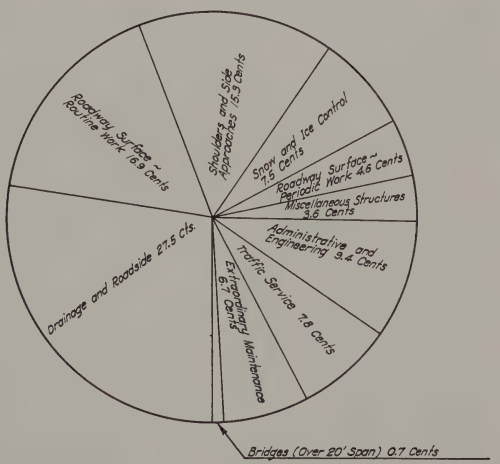

Shoulders and Side Approaches 9.5 Cents
Snow and Ice Control 7.5 Cents
Roadway Surface — Periodic Work 4.6 Cents
Miscellaneous Structures 3.6 Cents
Administrative and Engineering 9.4 Cents
Traffic Service 7.8 Cents
Extraordinary Maintenance 6.1 Cents
Bridges (Over 20' Span) 0.7 Cents
Drainage and Roadside 27.5 Cts.
Roadway Surface — Routine Work 16.9 Cents

TABLE NO. 8

MAINTENANCE MILEAGE AND EXPENDITURES BY ROAD TYPE FISCAL YEAR 1939

Type of road or construction	Mileage	Expenditures
Cement concrete	23.40	$15,897.69
Asphaltic concrete	41.14	36,526.48
Plantmixed bituminous-treated gravel	130.45	47,250.58
Roadmixed bituminous-treated gravel	2,300.75	608,140.20
Gravel	154.21	27,722.45
Graded and unimproved	155.95	31,527.36
Bridge maintenance	.....	10,194.55
Additions and betterments*	.....	53,618.38
	2,805.90	$830,877.69

*Comprising the following items:

Erection of new signs and markers	$3,618.82
Construction and repair of maintenance stations	31,375.10
Repairing damages caused by floods	11,457.22
Oil-mix stock pile	37.05
Street improvements Esmeralda 3–C–2	1,461.14
Repairs to Clark Avenue underpass	559.39
New riprap Mineral 3–E	3,826.40
New guard rail Washoe 17–A	1,283.26
	$53,618.38

MAINTENANCE COST PER MILE BY ROAD TYPE, FISCAL YEAR 1939

Type of surface	Mileage	Cost	Cost per mile
Cement concrete	23.40	$15,897.69	$679.39
Asphaltic concrete	41.14	36,526.48	887.86
Plantmixed bituminous-treated gravel	130.45	47,250.58	362.21
Roadmixed bituminous-treated gravel	2,300.75	608,140.20	264.32
Gravel	154.21	27,722.45	179.77
Graded and unimproved	155.95	31,527.36	202.16
	2,805.90	$767,064.76	*$273.37

*Average.

TABLE NO. 9

EXPENDITURES FOR VARIOUS MAINTENANCE OPERATIONS ON CEMENT CONCRETE, ASPHALTIC CONCRETE, AND PLANTMIX BITUMINOUS-TREATED GRAVEL ROADS, FISCAL YEAR 1939

Operation	Cement concrete	Percent	Asphaltic concrete	Percent	Plantmix	Percent
Building and repairing shoulders	$1,916.59	12.1	$9,220.23	25.2	$5,052.85	10.7
Filling expansion joints and cracks and patching surface	2,281.89	14.4	1,678.99	4.6	6,072.12	12.9
Cleaning ditches and culverts	2,457.66	15.5	3,154.87	8.6	3,733.20	7.9
Cutting weeds and brush	470.64	3.0	4,151.32	11.4	7,567.97	16.0
Repairing and cleaning surface ditches	367.37	2.3	61.83	.2	1,571.28	3.3
Repairing signs and markers	485.33	3.0	2,215.79	6.1	1,759.78	3.7
Removing slides and trimming slopes	1,628.06	10.2	1,975.81	5.4	5,086.54	10.8
Repairing washouts	71.27	.4	249.68	.7	2,753.41	5.8
Removing snow	1,094.74	6.9	2,329.05	6.4	2,032.35	4.3
Repairing guard rail	557.34	3.5	466.44	1.3	200.35	.4
Riprapping and protecting slopes	477.67	3.0	480.17	1.3	656.54	1.4
Removing debris and waste material along right-of-way	293.95	1.9	721.20	2.0	1,219.36	2.6
Repairing culverts	318.05	2.0	228.40	.6	175.29	.4
Repairing fences and gates on right-of-way	133.42	.8	706.19	1.9	296.89	.6
Painting traffic center line	496.26	3.1	1,129.04	3.1	1,303.20	2.8
Erecting, removing and repairing snow fence	203.71	1.3	2,183.52	6.0	751.31	1.6
Maintenance stations upkeep	355.78	2.2	356.93	1.0	101.67	.2
Repairing road approaches	.....	.....	.....	.....	65.99	.1
Landscape maintenance	516.11	3.2	1,487.68	4.0	2,648.87	5.6
Flattening slopes	358.84	2.3	.....	.....	13.85	.....
Sanding icy roads	.....	.....	612.26	1.7	145.16	.3
Rentals of garages, storage sheds, etc	91.46	.6	80.97	.2	114.94	.2
Administration	1,321.55	8.3	3,036.11	8.3	3,927.66	8.4
	$15,897.69	100.0	$36,526.48	100.0	$47,250.58	100.0

TABLE NO. 10

EXPENDITURES FOR VARIOUS MAINTENANCE OPERATIONS ON BITUMINOUS-TREATED, GRADED AND UNIMPROVED ROADS, FISCAL YEAR 1939

Operation	Bituminous-treated	Percent	Gravel	Percent	Graded and unimproved	Percent
Building and repairing shoulders	$84,043.28	13.8				
Filling expansion joints and cracks and patching surface	76,592.79	12.6				
Cleaning ditches and culverts	30,429.38	5.0	$712.05	2.6	$399.98	1.3
Cutting weeds and brush	71,958.72	11.9	701.01	2.6	225.95	.8
Dragging and blading	.....	.....	12,636.82	45.0	14,410.15	45.7
Repairing and cleaning surface ditches	5,197.72	.9	240.56	.9		
Raking rocks	.....	.....	233.57	.9	549.90	1.8
Erecting and repairing signs and markers	26,326.42	4.3	663.17	2.4	320.96	1.1
Removing slides and trimming slopes	33,902.20	5.5	431.41	1.6	297.80	.9
Repairing washouts	27,039.35	4.5	552.08	2.0	1,680.48	5.3
Hauling and spreading patching material	.....	.....	4,357.78	15.7	4,085.66	13.0
Snow removal	66,341.52	10.9	3,433.84	12.4	3,795.46	12.0
Repairing guard rail	2,213.71	.4	.....	.....	13.00	
Riprapping and protecting slopes	11,314.95	1.8	209.03	.8	57.00	.2
Removing debris and waste material along right-of-way	10,931.45	1.7	70.50	.3	15.20	
Repairing culverts	3,479.24	.6	91.69	.4	276.93	.8
Reconditioning	29,778.79	4.9				
Repairing fences and gates on right-of-way	573.31	.1	46.81	.2	64.00	.2
Painting traffic center line	10,829.58	1.7				
Erecting, removing and repairing snow fence	2,791.48	.5	637.74	2.3	333.48	1.1
Maintenance stations upkeep	13,218.11	2.1	122.06	.5	2,216.27	7.0
Seal coating	35,812.51	5.9				
Maintaining road approaches	690.90	.2	70.99	.3		
Landscape maintenance	1,736.58	.3				
Flattening slopes	5,153.24	.9	.....	.....	55.81	.2
Sanding icy roads	4,739.16	.8	161.89	.6		
Rentals of garages, storage sheds, etc.	2,164.00	.4	45.10	.2	108.80	.3
Maintenance roadside camps	468.70	.1				
Administration	50,413.11	8.2	2,304.32	8.3	2,620.53	8.3
	$608,140.20	100.0	$27,722.45	100.0	$31,527.36	100.0

TABLE NO. 11
EXPENDITURES FOR VARIOUS MAINTENANCE OPERATIONS ON BRIDGES, FISCAL YEAR 1939

Operation	Amount	Percent
Channel work	$1,863.29	18.3
Substructure—General repairs	807.77	7.9
Substructure—Painting	116.09	1.1
Superstructure—General repairs	706.34	6.9
Superstructure—Painting	242.49	2.4
Repairs to bridge surface	342.73	3.4
Approaches—General repairs and surfacing	3,007.49	29.5
Approaches—Guard rail	393.81	3.9
Supplementary maintenance including lighting, pumping system, etc.	1,037.95	10.2
Inspection and administration	1,676.59	16.4
	$10,194.55	100.0

TABLE NO. 12
TOTAL EXPENDITURES FOR MAINTENANCE AND BETTERMENT WORK IN EACH COUNTY, FISCAL YEAR 1939

County	Mileage	Expenditures
Churchill	157.32	$32,709.18
Clark	289.84	93,187.56
Douglas	76.63	35,323.93
Elko	401.29	121,932.63
Esmeralda	117.27	24,510.56
Eureka	120.63	35,631.16
Humboldt	152.10	27,006.81
Lander	130.71	36,584.77
Lincoln	198.64	41,565.18
Lyon	157.63	41,496.43
Mineral	83.52	28,087.57
Nye	380.05	91,378.09
Ormsby	26.69	14,770.98
Pershing	82.26	19,316.76
Storey	9.18	5,655.30
Washoe	165.46	104,088.66
White Pine	256.68	77,632.12
	2,805.90	$830,877.69

MAINTENANCE REPORT FOR THE FISCAL YEAR JULY 1, 1939, TO JUNE 30, 1940

During the State's fiscal year ending June 30, 1940, the Department of Highways spent $763,075.33 for maintaining 2,908.48 miles of highway. The total mileage includes improved and unimproved types of road and the total cost includes all direct and indirect charges to maintenance.

TABLE NO. 13

MAINTENANCE MILEAGE AND EXPENDITURES BY ROAD TYPE

FISCAL YEAR 1940

Type of road or construction	Mileage	Expenditures
Cement concrete	17.63	$17,177.15
Asphaltic concrete	44.19	27,641.04
Plantmixed bituminous-treated gravel	154.96	58,275.63
Roadmixed bituminous-treated gravel	2,415.90	592,761.26
Gravel	128.56	22,565.44
Graded and unimproved	147.24	20,908.84
Bridge maintenance	----------	5,591.43
Additions and betterments*	----------	18,154.54
	2,908.48	$763,075.33

*Comprising the following items:

Developing spring, including concrete box for emigrant station	$248.07
Purchase 10,000 lineal feet standard snow fence	1,762.63
Moving two houses, Mina to Coaldale, and modernizing same for maintenance station	7,075.67
Construction of garage contact maintenance station	3,104.12
Installing water line for Battle Mountain maintenance station	296.59
Constructing storm porch on maintenance house at North Fork	196.89
Repairing damage to shoulders and ditches caused by cloudburst, September 1939	1,063.55
Construction of maintenance dwelling at Charleston Park	890.58
Repainting maintenance houses at Peterson's camp	237.54
Installation of concrete floor in Fallon maintenance station	182.00
Drilling new well at Lida maintenance station	1,030.16
Removing, resetting and installing perforated drains on Clear Creek road	981.63
Completion of Rattlesnake maintenance station	1,085.11
	$18,154.54

MAINTENANCE COST PER MILE BY ROAD TYPE, FISCAL YEAR 1940

Type of surface	Mileage	Cost	Cost per mile
Cement concrete	17.63	$17,177.15	$974.31
Asphaltic concrete	44.19	27,641.04	625.50
Plantmixed bituminous-treated gravel	154.96	58,275.63	376.06
Roadmixed bituminous-treated gravel	2,415.90	592,761.26	245.35
Gravel	128.56	22,565.44	175.52
Graded and unimproved	147.24	20,908.84	142.00
	2,908.48	$739,329.36	*$254.20

*Average.

TABLE NO. 14

EXPENDITURES FOR VARIOUS MAINTENANCE OPERATIONS ON CEMENT CONCRETE, ASPHALTIC CONCRETE, AND PLANTMIX BITUMINOUS-TREATED GRAVEL ROADS, FISCAL YEAR 1940

Operation	Cement concrete	Percent	Asphaltic concrete	Percent	Plantmix	Percent
Building and repairing shoulders	$1,357.43	7.9	$5,509.85	19.9	$10,277.30	17.6
Filling expansion joints and cracks and patching surface	4,943.21	28.8	1,010.36	3.7	8,345.71	14.3
Cleaning ditches and culverts	2,261.54	13.2	3,731.64	13.5	4,666.32	8.0
Cutting weeds and brush	320.55	1.9	4,292.37	15.6	6,404.63	11.0
Repairing and cleaning surface ditches	.....	.....	28.49	.1	2,697.49	4.7
Repairing signs and markers	594.83	3.5	1,056.99	3.8	2,602.11	4.5
Removing slides and trimming slopes	1,342.44	7.8	759.42	2.7	5,028.72	8.6
Repairing washouts	518.27	3.0	1,270.48	4.6	2,680.00	4.6
Removing snow	439.88	2.6	1,063.66	3.8	1,531.49	2.6
Repairing guard rail	188.63	1.1	196.25	.7	101.65	.2
Riprapping and protecting slopes	.....	.....	.96	.....	822.23	1.4
Removing debris and waste material along right-of-way	16.78	.1	693.15	2.5	795.76	1.4
Repairing culverts	1.28	.....	136.58	.5	130.40	.2
Repairing fences and gates on right-of-way	91.24	.5	506.86	1.8	430.20	.7
Painting traffic center line	627.89	3.6	2,019.17	7.3	2,846.85	4.9
Erecting, removing and repairing snow fence	22.92	.1	1,007.56	3.7	2.43	
Maintenance stations upkeep	209.68	1.2	50.69	.2	63.33	.1
Landscape maintenance	2,656.57	15.5	1,313.36	4.8	3,140.99	5.4
Sanding icy roads	.....	.....	345.75	1.2	177.15	.3
Rentals of garages, storage sheds, etc.	6.50	.....	108.93	.4	178.88	.3
Administrative	1,577.51	9.2	2,538.52	9.2	5,351.99	9.2
	$17,177.15	100.0	$27,641.04	100.0	$58,275.63	100.0

TABLE NO. 15

EXPENDITURES FOR VARIOUS MAINTENANCE OPERATIONS ON BITUMINOUS-TREATED, GRADED AND UNIMPROVED ROADS, FISCAL YEAR 1940

Operation	Bituminous treated	Percent	Gravel	Percent	Graded and unimproved	Percent
Building and repairing shoulders	$98,672.79	16.7				
Filling expansion joints and cracks and patching surface	89,123.61	15.0				
Cleaning ditches and culverts	35,531.00	6.0	$2,217.06	9.8		
Cutting weeds and brush	64,183.26	10.8	404.52	1.8	$920.67	4.4
Dragging and blading	.....	.....	9,521.19	42.2	12,381.06	59.2
Repairing and cleaning surface ditches	5,071.54	.9	60.55	.3		
Raking rocks	.....	.....	228.76	1.0	186.22	.9
Erecting and repairing signs and markers	20,299.25	3.4	728.72	3.2	238.88	1.1
Removing slides and trimming slopes	43,424.17	7.3	250.00	1.1	426.85	2.0
Repairing washouts	25,152.58	4.2	2,196.23	9.8	1,065.59	5.1
Hauling and spreading patching material	.....	.....	1,512.59	6.7	1,499.22	7.2
Snow removal	40,474.36	6.8	1,218.21	5.1	502.08	2.4
Repairing guard rail	1,134.44	.2				
Riprapping and protecting slopes	3,769.39	.6				
Removing debris and waste material along right of way	10,448.01	1.8	84.90	.4	44.50	.2
Repairing culverts	2,053.35	.4	34.95	.2	101.50	.5
Reconditioning	26,068 00	4.4				
Repairing fences and gates on right of way	809.91	.1	135.42	.6		
Painting traffic center line	25,560.07	4.3				
Erecting, removing and repairing snow fence	5,032.84	.9	561.98	2.5		
Maintenance stations upkeep	18,038.91	3.0	820.93	3.6	1,477.78	7.1
Seal coating	9,412.02	1.6				
Maintaining road approaches	1,278.12	.2	24.19	.1		
Landscape maintenance	3,965.14	.7				
Flattening slopes	865.47	.2	.....	.....	144.28	.7
Sanding icy roads	4,994.09	.8	51.46	.2		
Rentals of garages, storage sheds, etc.	3,055.36	.5	441.43	1.9		
Administrative	54,343.28	9.2	2,072.35	9.2	1,920.21	9.2
	$592,761.26	100.0	$22,565.44	100.0	$20,908.84	100.0

TABLE NO. 16
EXPENDITURES FOR VARIOUS MAINTENANCE OPERATIONS ON BRIDGES, FISCAL YEAR 1940

Operation	Amount	Percent
Channel work	$284.98	5.1
Substructure—General repairs	471.19	8.4
Substructure—Painting	192.84	3.4
Superstructure—General Repairs	247.61	4.4
Superstructure—Painting	47.87	.9
Repairs to bridge surface	89.77	1.6
Approaches—General repairs and surfacing	858.50	15.3
Approaches—Guard rail	565.02	10.1
Supplementary maintenance, including lighting, pumping system, etc.	892.02	16.0
Inspection and administration	1,941.63	34.8
	$5,591.43	100.0

TABLE NO. 17
TOTAL EXPENDITURES FOR MAINTENANCE AND BETTERMENT WORK IN EACH COUNTY, FISCAL YEAR 1940

County	Mileage	Expenditures
Churchill	169.81	$40,856.45
Clark	304.53	87,425.52
Douglas	77.05	35,315.12
Elko	401.23	105,064.16
Esmeralda	208.40	48,181.27
Eureka	76.63	25,725.85
Humboldt	151.03	26,919.25
Lander	150.71	30,532.00
Lincoln	198.64	38,057.42
Lyon	157.62	40,345.35
Mineral	119.28	28,402.84
Nye	335.95	69,925.80
Ormsby	28.16	9,561.95
Pershing	84.30	15,935.45
Storey	9.55	7,875.37
Washoe	164.18	95,182.15
White Pine	271.41	57,769.38
	2,908.48	$763,075.33

TABLE NO. 18

CONTRACTS AWARDED BY STATE, JULY 1, 1938, TO JUNE 30, 1939

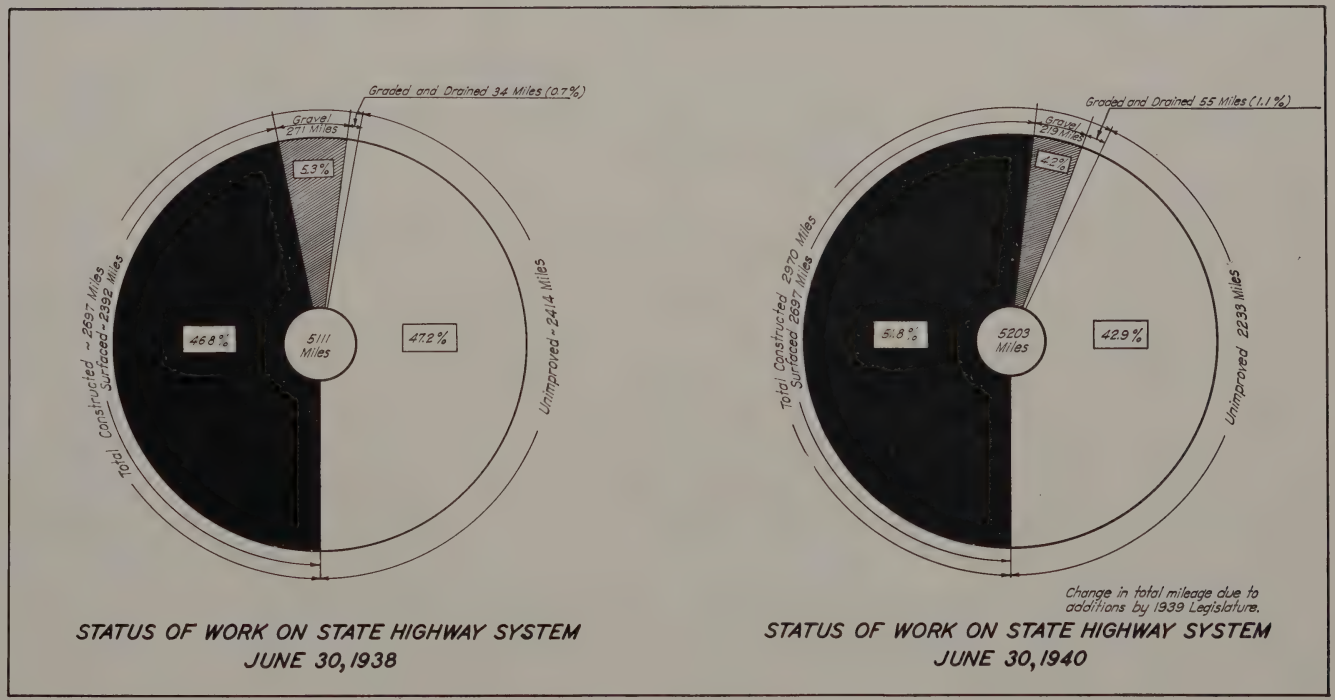
Contract No.	County	Length in miles	Type of construction	Termini
547	Humboldt	7.198	Roadmix	West foot of Golconda Summit to east foot Golconda Summit.
548	Humboldt		Water Pipe Line	Giroux and Melarkey Streets to Melarkey Street and Paradise Avenue in Winnemucca.
549	Humboldt	7.900	Gravel	10 miles northeast of junction Routes 8 and 8B to Paradise Valley.
550	Elko	.499	Roadmix	In city of Wells.
551	Storey	4.956	Roadmix	½ mile north of Virginia City to 5 miles northwest.
552	White Pine	9.792	Roadmix	East Ely to McGill.
553	Nye	12.749	Roadmix	West Forest Boundary to East Forest Boundary.
554	Humboldt	10.035	Roadmix	Junction Routes 8 and 8B to 10 miles northeast.
555	Eureka	4.618	Roadmix	Junction Route 1, 5.7 miles east of Dunphy to .8 mile north of Beowawe.
556	Lyon	12.100	Roadmix	8.5 miles north of Wabuska to Junction U S 50.
557	Washoe	5.216	Roadmix	Verdi to Lawton's.
558	Washoe		Signals	Grade crossing signals at Washoe City.
559	White Pine	.851	Concrete and Steel	Construction of overpass in East Ely.
560	Churchill	3.473	Roadmix	Junction Route 50, ½ mile south of Fallon to 3 miles southeast.
561	Pershing-Humboldt	7.863	Plantmix	3 mile southwest of Pershing-Humboldt County line to 5 miles south of Winnemucca.
562	Elko	4.788	Gravel Base	5 miles south of North Fork to North Fork.
563	Lincoln	9.952	Gravel	½ mile north of Panaca Junction to Pioche.
564	Clark	12.622	Plantmix	A point near Apex to 4 miles west of Crystal.
565	Clark	14.372	Roadmix	1½ miles north of Searchlight to 20 miles south of Railroad Pass.
566	Pershing	2.045	Roadmix	5 miles south of Lovelock to 7 miles south.
567	Churchill	9.104	Plantmix	½ mile west of Leeteville to Fallon.
568	Washoe	.927	Roadmix	2.7 miles north of California-Nevada State line to Verdi.
569	Nye	4.703	Gravel	2.7 miles west of Warm Springs to 2 miles east of Warm Springs.
570	White Pine	2.473	Roadmix	Ely through East Ely.
571	White Pine	14.929	Gravel	5 miles east of East Foot Connor's Pass to Sacramento Pass.
572	Storey	.471	Roadmix	Within Virginia City.
573	Clark	.951	Roadmix	½ mile south of Apex Underpass to ½ mile north, including underpass.
574	Elko	1.909	Roadmix	2 miles southwest of Deeth to Deeth, including widening overpass.
575	Mineral	3.257	Roadmix	Kinkead to 3 miles west.
576	Lincoln	9.952	Roadmix	½ mile north of Panaca Junction to Pioche.
577	Nye	11.515	Gravel	A point opposite Manhattan to a point opposite Round Mountain.
578	Nye	28.821	Roadmix	12¾ miles north of Junction Routes 4 and 8A to opposite Manhattan, and from 3 miles west of Warm Springs to 2 miles east of Warm Springs.

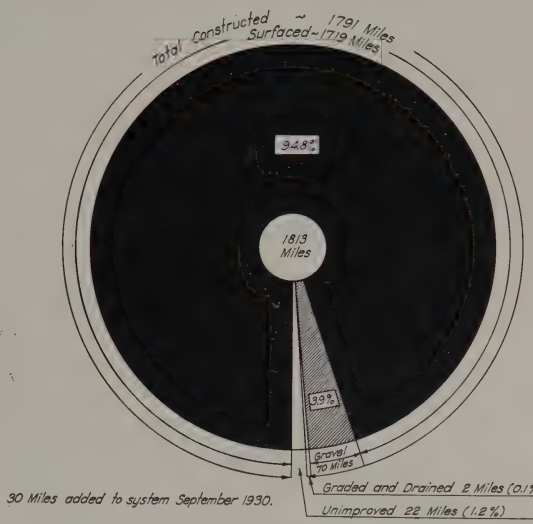
Table No. 18—Continued

CONTRACTS AWARDED BY STATE, JULY 1, 1939, TO JUNE 30, 1940

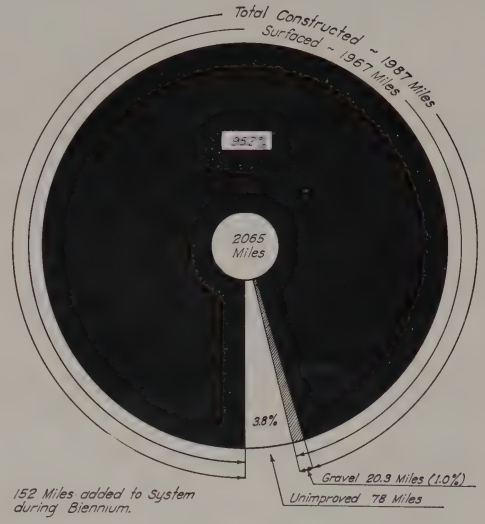
Contract No.	County	Length in miles	Type of construction	Termini
579*	Ormsby, Lyon	7.611	Plantmix	Junction Route 3 in Carson City to near Junction Routes 2A and 17.
580	Humboldt	7.900	Roadmix	10 miles north Junction Routes 8 and 8B to Paradise.
581	Lyon	2.440	Roadmix	½ mile east of Junction 2A and 1B to 4.5 miles west of Lahontan.
582	Eureka	.561	Roadmix	Between Shoshone Overpass and Dunphy Overpass, including reinforced concrete bridge.
583	Mineral	5.290	Roadmix	5.3 miles west of Basalt to Basalt.
584*	Elko	35.170	Roadmix	8.1 miles north of Elko to 5 miles south of North Fork.
585	Humboldt	11.897	Plantmix	Winnemucca to 3½ miles east of Button Point.
586*	Pershing	17.027	Plantmix	Churchill County line to Lovelock.
587*	Douglas	11.785	Plantmix	Topaz Junction to 3 miles north of Carter's.
588	White Pine		Concrete	Improvement to foundations of overpass .8 mile west of Ely.
589	Clark	4.278	Roadmix	3 miles south of Searchlight to 1½ miles north of Searchlight.
590	Pershing	2.007	Roadmix	West city limits of Lovelock to 2 miles west.
591	Lander	28.241	Gravel	20 miles south of Battle Mountain to 48 miles south.
592	Lyon	9.170	Roadmix	Junction U. S. 50 to 5 miles south of Fernley.
593	Eureka	.861	Roadmix	1 mile north of Beowawe to Beowawe, including reinforced concrete bridge.
594*	Eureka, Elko	8.685	Plantmix	1 mile west of Eureka-Elko County line to 1½ miles east of Vivian including stub into Carlin.
595*	Clark	12.611	Plantmix	California-Nevada State line to Jean.
596*	Clark	5.353	Plantmix	1 mile southwest of Glendale to west slope Mormon Mesa, including concrete and steel overpass.
597*	Nye	11.515	Roadmix	Opposite Manhattan to opposite Round Mountain.
598*	Esmeralda	9.815	Roadmix	Blair Junction to 10 miles south.
599*	Elko	4.789	Roadmix	5 miles south of North Fork to North Fork.
600*	White Pine	20.312	Roadmix	East foot Connor's Pass to Sacramento Pass.
601*	Clark	1.640	Footpaths	1 mile west of Mesquite to Mesquite.
602*	Elko	10.682	Plantmix	Near Deeth to Welcome.

*Under construction at end of biennium.


Graded and Drained 34 Miles (0.7%)
Gravel 271 Miles
5.3%
Total Constructed - 2637 Miles
Surfaced - 2392 Miles
46.8%
5111 Miles
47.2%
Unimproved - 2414 Miles
STATUS OF WORK ON STATE HIGHWAY SYSTEM
JUNE 30, 1938
Graded and Drained 55 Miles (1.1%)
Gravel 218 Miles
4.2%
Total Constructed 2970 Miles
Surfaced 2637 Miles
51.8%
5203 Miles
42.9%
Unimproved 2233 Miles
Change in total mileage due to additions by 1939 Legislature.
STATUS OF WORK ON STATE HIGHWAY SYSTEM
JUNE 30, 1940



STATUS OF WORK ON FEDERAL AID HIGHWAY SYSTEM
JUNE 30, 1938



STATUS OF WORK ON FEDERAL AID HIGHWAY SYSTEM
JUNE 30, 1940

Table No. 18—Continued

DAY LABOR CONSTRUCTION PROJECTS, JULY 1, 1938, TO JUNE 30, 1940

Day labor No.	County	Mileage	Type of construction	Location
135	Clark		Installing wig-wag signals	At Charleston Road in city of Las Vegas.
136	Clark		Installing wig-wag signals	At Railroad Pass near Boulder City.
137	Washoe		Roadmix asphaltic surface	Between 8th and 15th Streets in city of Sparks.
140	Mineral		Installing flashing-light signals	At grade crossing in Schurz.
141	Humboldt		Installing flashing-light signals	At grade crossing at Preble.
142	Clark		Widening shoulders	At junction of Routes 5 and 26 near Railroad Pass.
113	Nye		Construction right-of-way fence	Through Jim Butler property, vicinity of "5 Mile."
145	Washoe		Installing flashing-light signals	Western Pacific grade crossing on 4th Street, city of Reno.
146	Elko		Installing flashing-light signals	Grade crossing on U S 95 approximately 10 miles south of Wells.
147	White Pine		Gravel base and oil-gravel surface	Vicinity of Annand and Mill Streets, city of Ely.
148	Eureka		Gravel base and oil-gravel surface	Main Street in city of Eureka.
149	White Pine	4.714	Reconditioning highway	U S 50 between Keystone and Ely.
150	Washoe		Installing flashing-light signals	Grade crossings at Vine, Washington, Ralston, Chestnut, and West Streets in Reno.
151	Lyon		Installing flashing-light signals	Grade crossings approximately 5 miles west of Lahontan.
152	Lyon		Installing flashing-light signals	Grade crossings near Weeks.
153	Churchill		Installing flashing-light signals	Grade crossings near Hazen.
154	Esmeralda	25.000	Equipment rental	Improvement of 25 miles of road through Fish Lake Valley.
155	Storey	1.100	Applying oil and screenings	Street in Gold Hill.
156	Elko		Cattle guard and fencing	North Fork.
157	Elko		Installing flashing-light signals	Grade crossings on Hot Springs Road near Elko.
159	Douglas		Improve approaches	Streets in Minden and Gardnerville.
160	Washoe		Construction of guard rail	On Geiger grade.
161	Douglas		Construction of guard rail	Near Zephyr Point, Lake Tahoe.
162	Churchill		Rebuilding and stabilizing irrigation ditch	West of Fallon.
163	Nye		Constructing rubble retaining wall	Near Tonopah.
164	Churchill		Stabilizing river bank with sheet piling	West of Fallon.
165	Elko		Furnishing and placing tunnel timber	Near Patsville.
166	Nye		Drainage improvement	South of Beatty.
167	Humboldt		Installing flashing-light signals	Grade crossing on Bridge Street in Winnemucca.
168	Clark		Installing flashing-light signals	Grade crossing south of Las Vegas.
169	Eureka		Installing flashing-light signals	W. P. R. R. grade crossing at Beowawe.
170	Eureka		Installing flashing-light signals	S. P. R. R. grade crossing at Beowawe.
171	Esmeralda	7.500	Placing gravel on roadway	Between junction U S 95 and Lida.
172	Pershing		Installing flashing-light signals	Grade crossings at Main and 9th Streets in Lovelock.
174	Elko		Installing flashing-light signals	Grade crossings 3d, 4th, 5th, 6th, 7th, 8th, and 9th Streets in Elko, W. P. R. R.
175	Elko		Installing flashing-light signals	Grade crossings 3d, 4th, 5th, 6th, and 9th Streets, S. P. R. R. in Elko.

176	Pershing		Construction of cattle drive	West of Lovelock.
177	Pershing		Construction of guard rail	East of Lovelock.
178	Nye	3.000	Reconstruction road	Sandy Summit to Black Rock Summit.
179	Humboldt	16.000	Maintaining road	Golconda to Red House Junction.

DAY LABOR ROADSIDE IMPROVEMENT PROJECTS, JULY 1, 1938, TO JUNE 30, 1940

Day labor No.	County	Mileage	Type of construction	Location
138	Humboldt		Tree planting and roadside improvement	Melarkey Street in Winnemucca.
144	White Pine		Installing guide posts	Keystone to Ely.
158	Mineral		Stock piling surface material	For use through Hawthorne.
173	Churchill		Landscaping	Leeteville to Fallon.

TABLE NO. 19

TABLE SHOWING PROGRESS STATUS OF THE FEDERAL AID HIGHWAY SYSTEM, STATE HIGHWAYS NOT ON FEDERAL AID SYSTEM, AND ENTIRE STATE HIGHWAY SYSTEM AS OF JUNE 30, 1938, THE CLOSE OF THE LAST BIENNIUM

County	Federal Aid System			Remaining State Highway System			Entire State Highway System		
	Completed	Unimproved	Totals	Completed	Unimproved	Totals	Completed	Unimproved	Totals
Churchill	125.89	.....	125.89	28.39	53.90	82.29	154.28	53.90	208.18
Clark	140.00	.....	140.00	160.05	174.25	334.30	300.05	174.25	474.30
Douglas	60.04	.....	60.04	16.59	12.30	28.89	76.63	12.30	88.93
Elko	333.43	.....	333.43	34.82	380.65	415.47	368.25	380.65	748.90
Esmeralda	97.22	.....	97.22	58.18	57.45	115.63	155.40	57.45	212.85
Eureka	72.01	.....	72.01	5.65	186.85	192.50	77.66	186.85	264.51
Humboldt	133.10	.....	133.10	18.00	218.55	236.55	151.10	218.55	369.65
Lander	108.09	.....	108.09	20.00	175.35	195.35	128.09	175.35	303.44
Lincoln	79.18	.....	79.18	119.45	105.10	224.55	198.63	105.10	303.73
Lyon	108.16	.....	108.16	49.50	68.25	117.75	157.66	68.25	225.91
Mineral	109.10	21.88	130.98	10.51	76.85	87.36	119.61	98.73	218.34
Nye	32.93	.....	32.93	245.98	339.26	585.24	278.91	339.26	618.17
Ormsby	20.66	.....	20.66	4.95	.....	4.95	25.61	.....	25.61
Pershing	74.98	.....	74.98	5.27	173.20	178.47	80.25	173.20	253.45
Storey	9.38	.....	9.38	.....	14.05	14.05	9.38	14.05	23.43
Washoe	96.84	.....	96.84	68.66	227.20	295.86	165.50	227.20	392.70
White Pine	191.01	.....	191.01	58.64	128.90	187.54	249.65	128.90	378.55
Totals	1,792.02	21.88	1,813.90	904.64	2,392.11	3,296.75	2,696.66	2,413.99	5,110.65

TABLE SHOWING PROGRESS STATUS OF THE FEDERAL AID HIGHWAY SYSTEM, STATE HIGHWAYS NOT ON FEDERAL AID SYSTEM, AND ENTIRE STATE HIGHWAY SYSTEM AS OF JUNE 30, 1940, THE CLOSE OF THE BIENNIUM

County	Federal Aid System			Remaining State Highway System			Entire State Highway System		
	Completed	Unimproved	Totals	Completed	Unimproved	Totals	Completed	Unimproved	Totals
Churchill	125.80	.....	125.80	50.51	55.90	106.41	176.31	55.90	232.21
Clark	198.63	17.30	215.93	146.58	163.70	310.28	345.21	181.00	526.21
Douglas	59.98	.....	59.98	17.03	12.30	29.33	77.01	12.30	89.31
Elko	331.86	.....	331.86	60.41	344.23	404.64	392.27	344.23	736.50
Esmeralda	97.22	.....	97.22	88.18	28.50	116.68	185.40	28.50	213.90
Eureka	73.27	.....	73.27	5.48	187.00	192.48	78.75	187.00	265.75
Humboldt	132.85	.....	132.85	17.93	217.65	235.58	150.78	217.65	368.43
Lander	108.09	.....	108.09	49.06	145.90	194.96	157.15	145.90	303.05
Lincoln	80.14	.....	80.14	96.35	127.82	224.17	176.49	127.82	304.31
Lyon	108.13	.....	108.13	49.52	70.40	119.92	157.65	70.40	228.05
Mineral	109.11	21.88	130.99	10.18	76.85	87.03	119.29	98.73	218.02
Nye	133.45	.....	133.45	181.08	304.04	485.12	314.53	304.04	618.57
Ormsby	20.69	.....	20.69	7.32	2.40	9.72	28.01	2.40	30.41
Pershing	74.98	.....	74.98	11.80	170.14	181.94	86.78	170.14	256.92
Storey	9.55	.....	9.55	.....	18.05	18.05	9.55	18.05	27.60
Washoe	96.76	.....	96.76	96.52	213.74	310.26	193.28	213.74	407.02
White Pine	248.56	18.04	266.60	18.83	91.95	110.73	267.39	109.99	377.38
Totals	2,009.04	57.22	2,066.29	906.78	2,230.57	3,137.35	2,915.85	2,287.79	5,203.64

TABLE NO. 20

STATUS OF MILEAGE ON STATE HIGHWAY SYSTEM BY TYPES

Type	As of June 30, 1938	As of June 30, 1940
Unimproved	2,413.99	2,233.01
Graded and drained	34.31	54.78
Total unsurfaced	2,448.30	2,287.79
Crushed gravel or stone surface	271.08	218.60
Roadmix asphaltic surface	2,198.82	2,443.91
Emulsified asphaltic retread	3.76	5.19
Plantmix asphaltic surface	130.27	191.58
Asphaltic concrete	40.16	43.20
Portland cement concrete	13.99	9.16
Miscellaneous	4.27	3.98
Total surfaced	2,662.35	2,915.62
Grand total	5,110.65	*5,203.41

*Change in total mileage due to additions to State System and redesignation of routes by 1939 Legislature and new alignment.

TABLE NO. 21

MILES OF HIGHWAY CONSTRUCTED DURING BIENNIUM AND MILES OF HIGHWAY UNDER CONSTRUCTION AT CLOSE OF BIENNIUM ON STATE HIGHWAY SYSTEM.

Type	Miles completed during biennium July 1, 1938, to June 30, 1940	Miles under construction at close of bennium June 30, 1940	Total miles
Crushed gravel	73.88	.....	73.88
Roadmix asphalt	348.11	81.61	*429.72
Plantmix asphalt	49.09	66.14	115.23
Asphaltic concrete	3.98	.....	3.98
	475.06	147.75	622.81

*Includes 142.10 miles of oiling only.

TABLE NO. 22

NEVADA FOREST HIGHWAY SYSTEM

As of June 30, 1940

Route No.	Termini	Forest	Approx. length	Type
1....Lake Tahoe	Spooner north to California State line	Mono	15.7	Roadmix
2....Mount Rose (Incline)	Incline to Reno Hot Springs	Mono	22.9	7.3 Roadmix
3....Glenbrook	California State line to Spooner	Mono	12.8	Roadmix
4....Carson Canyon	Minden junction to California State line	Mono	7.9	Roadmix
5....Topaz (U S 395)	Holbrook junction to California State line	Mono	3.5	Roadmix
6....Dalzell Canyon	Wellington to California State line	Mono	30.8	Unimproved
7....Austin, east and west highway (U S 50)	Railroad Pass to east line forest boundary extended	Toiyabe	65.3	Roadmix
8....Big Smoky Valley	Austin to Eureka to south forest boundary	Toiyabe	75.8	20.6 Roadmix
9....Manhattan-Belmont	Manhattan to Belmont	Toiyabe	14.8	Unimproved
10....Midland Trail (Tonopah road)	West forest boundary to end of B. P. R. Survey	Toiyabe	18.5	Roadmix
11....Mount Charleston Road	East forest boundary to Mount Charleston	Nevada	3.7	Roadmix
12....Midland Trail	Butler's ranch to approx. 2 miles south of White River bridge	Nevada	18.4	Roadmix
13....Midland Trail	Ely to Holt Creek	Nevada	12.0	Roadmix
14....Grand Central (Connor's Pass) (U S 93)	Spring Valley road	Nevada	26.5	Roadmix
15....Ruby Valley	West Valley road to Forks	Ruby division Humboldt	11.1	Unimproved
16....Kingsbury	U S 50 to Minden junction	Mono	12.3	Unimproved
18....Owyhee Canyon	West Shoshone Indian Reservation to south forest boundary	Humboldt	48.6	13.5 Roadmix
20....Lehman Caves	Ely to Milford road camp ground plus .35 mile spur	Nevada	9.5	Unimproved
			410.1	

TABLE NO. 23

FOREST HIGHWAY FUND APPORTIONMENTS TO NEVADA

1922	$55,352.00
1923	152,632.00
1924	75,915.00
1925	75,799.00
1926	97,249.00
1927	96,939.00
1928	96,603.00
1929	93,867.00
1930	94,463.00
1931	187,058.00
1932	187,008.00
1933	319,204.00
1934	312,310.00
1935	132,492.00
1936	131,537.00
1937	128,935.00
1938	171,272.00
1939	170,505.00
1940	121,561.00
1941	157,822.00

CONTRACTS AWARDED FOR FOREST HIGHWAY CONSTRUCTION UNDER SUPERVISION OF PUBLIC ROADS ADMINISTRATION, JULY 1, 1938, TO JUNE 30, 1940.

County	National Forest	Mileage	Type	Location	Approximate cost
Elko	Humboldt	2.578	Grading	Mountain City highway	$50,217.46
Elko	Humboldt	10.132	Gravel base	Mountain City highway	44,622.84
Elko	Humboldt	1.818	Grading and bridge	Mountain City highway	53,149.03
Elko	Humboldt	6.927	Grading and gravel base	Mountain City highway	49,315.23
Elko	Humboldt	7.109	Grading	Mountain City highway	102,237.27

TABLE NO. 24

REVISED DESCRIPTION OF FEDERAL AID ROUTES STATE OF NEVADA

F.A. Route No.	Termini	Mileage in Federal reservations	Mileage outside reservations	Total mileage
1	From the California-Nevada State line near Verdi via Reno, Fernley, Lovelock, Winnemucca, Battle Mountain, Elko, and Wells, to the Nevada-Utah State line at Wendover, Utah, with a spur to Railroad Street in Carlin	2.906	415.645	418.551
2	From a point on Federal Aid Route 1 approximately 1 mile east of Fernley via Hazen, Fallon, Austin, Eureka, Ely, and Pioche to Caliente	12.272	408.963	421.235
3	From the Nevada-California State line near Purdy, California, via Reno, Carson City, Minden, Yerington, Hawthorne, and Tonopah to the south city limits of Goldfield with a spur connection from a point near Holbrook to to the Nevada-California State line en route to Bridgeport	39.475	270.473	309.948
4	From the Nevada-California State line near Bijou, California, to a point on Federal Aid Route 3 approximately 3 miles south of Carson City, and from another point on Federal Aid Route 3 at Carson City via Mound House and Dayton to a point on Federal Aid Route 2 near Leeteville	.....	75.656	75.656
5	From the Nevada-Arizona State line near Mesquite via Las Vegas to the Nevada-California State line southwest of Jean	.....	128.113	128.113
6	From a point on Federal Aid Route 1 in Winnemucca via Orovada to the Nevada-Oregon State line near McDermitt	.....	73.929	73.929
7	From a point on Federal Aid Route 2 at the east city limits of Ely via McGill to a point on Federal Aid Route 1 near Wendover, Utah	.....	118.231	118.231
8	From a point on Federal Aid Route 3 approximately 10 miles south of Reno via Virginia City to a point on Federal Aid Route 4 near Mound House	.....	22.273	22.273

Table No. 24—Continued

F.A. No. Route	Termini	Mileage in reservations Federal	Mileage reservations outside	mileage Total
9	From a point on Federal Aid Route 1 approximately 1 mile east of Wells via Contact to the Nevada-Idaho State line en route to Twin Falls, Idaho	.....	67.733	67.733
10	From a point on Federal Aid Route 7 approximately 4 miles south of the Elko-White Pine County line to a point on Federal Aid Route 1 approximately 1 mile east of Wells	.....	78.881	78.881
11	From a point on Federal Aid Route 5 in Las Vegas via Boulder City to Nevada-Arizona State line at Boulder Dam	13.515	17.932	31.447
12	From a point on Federal Aid Route 3 near Rhodes via Basalt to the Nevada-California State line near Benton, California	.....	34.170	34.170
13	From a point on Federal Aid Route 12 near Basalt to a point on Federal Aid Route 3 near Coaldale	.....	22.332	22.332
14	From a point on Federal Aid Route 3 in Tonopah via Warm Springs and Currant Creek to a point on Federal Aid Route 2 in Ely	26.227	141.846	168.073
15	From a point on Federal Aid Route 11 at Railroad Pass via Searchlight to the Nevada-California State line en route to Needles, California	5.322	50.999	56.321
16	From a point on Federal Aid Route 2 at East Foot of Connor's Pass via Sacramento Pass to the Nevada-Utah State line en route to Delta, Utah	.....	38.348	38.348
Totals		99.717	1,965.524	2,065.241

SUMMARY FEDERAL AID SYSTEM

Total Miles by Types as of June 30, 1940

Unimproved	77.96
Gravel surface	20.31
Roadmix asphaltic surface	1,731.51
Plantmix asphaltic surface	178.19
Asphaltic concrete	39.55
Cement concrete	9.15
Asphaltic retread	4.61
Miscellaneous	3.98
	2,065.26

TABLE NO. 25

BRIDGES OF MORE THAN 20 FEET CLEAR SPAN AS OF JUNE 30, 1940

Structure No.	County	Location	Type of structure	Length in feet
B– 95	Churchill	Canal between Hazen and Leeteville[1]	Reinforced concrete girder	52
B– 97	Churchill	Carson River west of Fallon[4]	Reinforced concrete pile trestle	174
B– 98	Churchill	Truckee-Carson Canal west of Fallon[4]	Reinforced concrete pile trestle	90
B–100	Churchill	Canal 1 mile south of Fallon	Reinforced concrete girder	43
B–105	Churchill	Eastgate	Reinforced concrete girder	55
B–240	Churchill	Between Fallon and Schurz	Timber trestle	59
B–241	Churchill	Canal 4 miles south of Fallon on Schurz road	Timber pile trestle	33
B–242	Churchill	Canal ½ mile south of Fallon on Schurz road	Timber pile trestle	52
B–244	Churchill	Truckee Canal at Lahontan	Steel I-beam, concrete deck	75
B–282	Churchill	Between Westgate and Eastgate	Reinforced concrete box culvert	23
B–288	Churchill	Between Fallon and Stillwater	Reinforced concrete girder	42
B–290	Churchill	Between Fallon and Stillwater	Timber trestle	39
B–291	Churchill	Between Fallon and Stillwater	Timber trestle	25
B–292	Churchill	Between Fallon and Stillwater	Timber trestle	40
B–293	Churchill	Between Fallon and Stillwater	Reinforced concrete girder	43
B–301	Churchill	Canal ½ mile north of Fallon	Timber pile trestle	57
B–302	Churchill	Carson River 1 mile north of Fallon	Timber pile trestle	78
B–345	Churchill	35 miles north of Fallon[2]	Timber truss	76
B–391	Churchill	Canal between Hazen and Leeteville	Steel I-beam, concrete deck	*59
B– 64	Clark	Between Bard and Las Vegas	Timber trestle	40
B– 65	Clark	Between Bard and Las Vegas	Timber trestle	40
B– 66	Clark	Between Bard and Las Vegas	Timber trestle	40
B– 67	Clark	Between Bard and Las Vegas	Timber trestle	59
B– 72	Clark	Between Bard and Las Vegas	Timber trestle	59
B– 74	Clark	In city of Las Vegas	Reinforced concrete box culvert	22
B– 76	Clark	Las Vegas Wash near Las Vegas	Reinforced concrete box culvert	67
B– 78	Clark	4.4 miles southwest of Crystal	Reinforced concrete box culvert	44
B– 81	Clark	Muddy River near Glendale	Steel truss	166
B- 84	Clark	12 miles west of Bunkerville	Reinforced concrete box culvert	23
B– 85	Clark	Lower Virgin River at Riverside	Reinforced concrete girder	854
B– 87	Clark	Near Bunkerville	Reinforced concrete box culvert	23
B– 89	Clark	Upper Virgin River between Bunkerville and Mesquite	Reinforced concrete girder	954
B– 90	Clark	Near Mesquite	Reinforced concrete box culvert	33
B– 91	Clark	Wash at Mesquite	Reinforced concrete box culvert	48
B–192	Clark	Wash 7 miles southeast Las Vegas on Boulder City road	Reinforced concrete box culvert	81
B–194	Clark	Wash 2 miles southeast Las Vegas on Boulder City road	Reinforced concrete box culvert	41
B–197	Clark	Between Glendale and Logandale	Timber trestle	59
B–222	Clark	3 miles west of Boulder City	Reinforced concrete box culvert	29
B–248	Clark	Near Logandale	Timber trestle	130
B–254	Clark	Charleston Park	Timber trestle	58
B–255	Clark	Charleston Park	Timber trestle	77
B–256	Clark	Charleston Park	Timber trestle	59

Table No. 25—Continued

Structure No.	County	Location	Type of structure	Length in feet
B–281	Clark	Muddy River near Moapa	Concrete slab on steel piles	114
B–313	Clark	Between Las Vegas and Apex	Reinforced concrete box culvert	25
B–314	Clark	Between Las Vegas and Apex	Timber trestle with concrete deck	97
B–315	Clark	Between Las Vegas and Apex	Timber trestle with concrete deck	78
B–316	Clark	Between Las Vegas and Apex	Timber trestle with concrete deck	40
B–317	Clark	Between Las Vegas and Apex	Timber trestle with concrete deck	78
B–318	Clark	Between Las Vegas and Apex	Timber trestle with concrete deck	40
B–319	Clark	Between Las Vegas and Apex	Timber trestle with concrete deck	39
B–320	Clark	Between Las Vegas and Apex	Timber trestle with concrete deck	39
B–321	Clark	Between Las Vegas and Apex	Timber trestle with concrete deck	40
B–335	Clark	23 mile southeast of Crystal[2]	Steel I-beam, timber deck	29
B–342	Clark	Boulder Dam[2]	Mass concrete	950
B–161	Douglas	3 miles south of Gardnerville	Reinforced concrete girder	27
B–169	Douglas	Carson River at Cradlebaugh	Reinforced concrete pile trestle	200
B–170	Douglas	Slough at Cradlebaugh	Reinforced concrete pile trestle	74
B–202	Douglas	Cottonwood Slough on Woodfords road	Timber trestle	40
B–203	Douglas	Carson River on Woodfords road	Timber trestle	97
B–204	Douglas	Fred's Fork or Home Slough on Woodfords road	Timber trestle	40
B–205	Douglas	Hogrefe or Rocky Slough on Woodfords road	Timber trestle	40
B–207	Douglas	West Fork of Carson River on Woodfords road	Timber trestle	75
B–284	Douglas	Gardnerville to Centerville	Reinforced concrete girder	103
B–285	Douglas	Gardnerville to Centerville	Reinforced concrete box culvert	33
B–287	Douglas	Gardnerville to Centerville	Reinforced concrete box culvert	44
B–297	Douglas	Genoa Lane	Timber trestle	58
B–298	Douglas	Genoa Lane	Timber trestle	86
B–299	Douglas	Genoa Lane	Timber trestle	39
B–357	Douglas	Carson River on Kingsbury grade road[2]	Timber truss	140
B–358	Douglas	Carson River on Kingsbury grade road[2]	Timber truss	33
B–359	Douglas	Carson River on Kingsbury grade road[2]	Timber truss	28
B–360	Douglas	Carson River on Kingsbury grade road[2]	Timber truss	22
B–361	Douglas	Carson River on Kingsbury grade road[2]	Timber beams	104
B– 45	Elko	Near Carlin[4]	Concrete girder	39
B– 50	Elko	North Fork Humboldt River near Halleck	Steel I-beam, concrete deck	44
B– 54	Elko	Mary's River near Deeth[1]	Reinforced concrete girder	44
B –55	Elko	Humboldt River near Deeth[1]	Steel truss	75
B–230	Elko	Thousand Springs Creek north of Wells	Reinforced concrete girder	35
B–231	Elko	Little Salmon River near Contact	Timber pile trestle	87
B–232	Elko	Little Salmon River near State line	Reinforced concrete girder	83
B–233	Elko	5th Street in Elko	Reinforced concrete girder	121
B–346	Elko	Humboldt River near Halleck[2]	Timber truss	48
B–347	Elko	Humboldt River near Halleck[2]	Timber truss	80
B–348	Elko	South Fork Owyhee River east of Tuscarora[2]	Steel I-beam, timber floor	23
B–349	Elko	South Fork Owyhee River north of Tuscarora[2]	Steel I-beam, timber floor	22
B–350	Elko	Owyhee River near Owyhee[2]	Steel I-beam, timber floor	36
B–351	Elko	Owyhee River near Mountain City[2]	Timber	40

B–352	Elko	North Fork Humboldt River near North Fork[2] [1]	Steel I-beam	22
B–353	Elko	Smith Creek near Jiggs[2]	Timber	22
B–354	Elko	Smith Creek south of Jiggs[2]	Steel I-beam	38
B–355	Elko	South Fork of Humboldt River south of Jiggs[2]	Timber truss	30
B–356	Elko	South Fork of Humboldt River south of Jiggs[2]	Timber beam	26
B–381	Elko	Owyhee River 12 miles north of North Fork[2]	Concrete rigid frame	*76
B–390	Elko	North Fork Humboldt River near North Fork	Reinforced concrete box culvert	*23
B–398	Elko	Maggie Creek near Carlin	Reinforced concrete box culvert	†23
B–406	Elko	Mary's River near Deeth	Concrete slab on steel piles	†91
B–407	Elko	Humboldt River near Deeth	Concrete slab on steel piles	†108
B–412	Elko	Owyhee River 8 miles south of Mountain City[2]	Timber	44
B–137	Esmeralda	Near Coaldale	Reinforced concrete box culvert	32
B–200	Esmeralda	Between Basalt and Coaldale	Timber trestle	112
B– 37	Eureka	Humboldt River at Dunphy[1]	Steel truss	126
B– 39	Eureka	Canal at Dunphy	Reinforced concrete box culvert	27
B–113	Eureka	East of Lander-Eureka County line	Reinforced concrete box culvert	23
B–283	Eureka	Approach road at Dunphy[3]	Timber trestle	36
B–365	Eureka	Humboldt River near Beowawe[2] [1]	Steel truss	100
B–366	Eureka	8 miles northwest of Eureka[2]	Timber	22
B–367	Eureka	Humboldt River near Palisade[2]	Timber	118
B–395	Eureka	Humboldt River Bridge near Dunphy	Concrete slab on steel piles	*151
B–396	Eureka	Humboldt River Bridge near Beowawe	Concrete slab on steel piles	*151
B–223	Humboldt	Humboldt River at Winnemucca	Steel I-beam, concrete deck and piers	190
B–226	Humboldt	Quinn River near Nevada-Oregon State line	Reinforced concrete box culvert	29
B–362	Humboldt	Humboldt River near Golconda[2]	Timber	58
B–363	Humboldt	Between Paradise Hill and Quinn River crossing[2]	Timber	22
B–364	Humboldt	Quinn River near Quinn River crossing[2]	Timber	38
B– 33	Lander	Reese River east of Battle Mountain	Reinforced concrete box culvert	26
B– 34	Lander	Reese River east of Battle Mountain	Reinforced concrete box culvert	26
B–108	Lander	Reese River between Railroad Pass and Austin	Timber pile trestle	62
B–109	Lander	Reese River between Railroad Pass and Austin	Timber pile trestle	52
B–112	Lander	3 miles west of Lander-Eureka County line	Reinforced concrete box culvert	34
B–325	Lander	Reese River south of Battle Mountain	Timber trestle	41
B–213	Lincoln	Between junction Alamo-Delamar road and Caliente	Timber trestle	32
B–214	Lincoln	Between junction Alamo-Delamar road and Caliente	Timber trestle	47
B–215	Lincoln	Between junction Alamo-Delamar road and Caliente	Timber trestle	47
B–216	Lincoln	Between junction Alamo-Delamar road and Caliente	Timber trestle	47
B–217	Lincoln	Between junction Alamo-Delamar road and Caliente	Timber trestle	32
B–218	Lincoln	Between junction Alamo-Delamar road and Caliente	Timber trestle	32
B–219	Lincoln	Meadow Valley Wash west of Caliente	Steel truss	164
B–220	Lincoln	Meadow Valley Wash north of Caliente	Steel I-beam, concrete piers and abutments	102
B–250	Lincoln	Canal east of Panaca	Timber trestle	88
B–275	Lincoln	Meadow Valley Wash west of Panaca	Timber trestle	27
B–305	Lincoln	Between Caliente and Panaca	Timber trestle	98
B–306	Lincoln	Between Caliente and Panaca	Timber trestle	94
B–312	Lincoln	Between Caliente and Panaca	Timber trestle	40

Table No. 25—Continued

Structure No.	County	Location	Type of structure	Length in feet
B–144	Lyon	East Walker River south of Yerington	Reinforced concrete girder	65
B–145	Lyon	Slough at Wilson Canyon	Reinforced concrete girder	27
B–146	Lyon	West Walker River at Wilson Canyon	Reinforced concrete girder	55
B–147	Lyon	West Walker River at Wilson Canyon	Reinforced concrete box culvert	22
B–149	Lyon	West Walker River at Bulkhead	Reinforced concrete arch	80
B–158	Lyon	West Walker River at Hoye	Reinforced concrete girder	63
B–159	Lyon	Simpson Canal near Wellington	Reinforced concrete girder	41
B–238	Lyon	Truckee Canal near Fernley	Steel truss	59
B–245	Lyon	Walker River 1 mile west of Yerington[2]	Steel I-beam	78
B–333	Lyon	Carson River at Towle Ranch	Continuous concrete girder	153
B–375	Lyon	Between Dayton and Silver City[2]	Timber	30
B–376	Lyon	1 mile southeast of Wellington[2]	Concrete arch	26
B–140	Mineral	Between Dutch Creek and Schurz	Reinforced concrete box culvert	27
B–239	Mineral	Walker River near Schurz	Timber pile trestle	97
B–180	Nye	East of Tonopah	Reinforced concrete box culvert	47
B–268	Nye	30 miles east of Tonopah	Reinforced concrete box culvert	32
B –28	Pershing	Humboldt River near Lovelock	Reinforced concrete pile trestle	146
B– 1	Washoe	Truckee River west of Verdi[1]	Reinforced concrete arch	194
B– 2	Washoe	Power Canal near Verdi	Steel plate girder	75
B– 3	Washoe	Truckee River east of Verdi[1]	Reinforced concrete arch	141
B– 4	Washoe	Highland Canal near Mogul[1]	Reinforced concrete girder	52
B– 16	Washoe	Truckee River near Wadsworth	Reinforced concrete girder	268
B–127	Washoe	Highland Canal near Mogul	Reinforced concrete box culvert	*44
B–177	Washoe	Evans Creek south of Reno	Reinforced concrete arch	40
B–178	Washoe	Truckee River, Virginia Street, Reno[2]	Reinforced concrete arch	148
B–234	Washoe	Steamboat Creek near Steamboat	Timber beams on steel bents	30
B–260	Washoe	Alameda Avenue, Reno	Steel I-beam, concrete piers	190
B–303	Washoe	Sierra Street, Reno	Continuous steel girders	136
B–304	Washoe	Lake Street, Reno[3]	Continuous reinforced concrete girder	153
B–334	Washoe	At Incline	Reinforced concrete box culvert	23
B–336	Washoe and Storey	Truckee River on Route 45 east of Sparks[2]	Timber truss	126
B–337	Washoe	7 miles north of Nixon[2]	Timber truss	23
B–338	Washoe	25 miles north of Gerlach[2]	Timber truss	34
B–339	Washoe	32 miles north of Gerlach[2]	Timber truss	28
B–340	Washoe	34 miles north of Gerlach[2]	Timber truss	28
B–341	Washoe	36 miles north of Gerlach[2]	Timber truss	34
B–377	Washoe	Truckee River near Nixon[2]	Steel I-beam timber deck	166
B–378	Washoe	Truckee River east of Verdi	Reinforced concrete arch	*205
B–380	Washoe	Truckee River west of Verdi	Reinforced concrete arch	*181
B–185	White Pine	White River 30 miles southwest of Ely	Timber trestle	39
B–328	White Pine	East foot of Connors Pass	Reinforced concrete box culvert	25

*Constructed during biennium.
†Under construction as of June 30, 1940.
[1]Abandoned during biennium due to relocation.
[2]Not built by State Highway Department.
[3]On feeder roads; not State Highway System.
[4]Widened during biennium.

GRADE SEPARATION STRUCTURES ON NEVADA STATE HIGHWAY SYSTEM AS OF JUNE 30, 1940

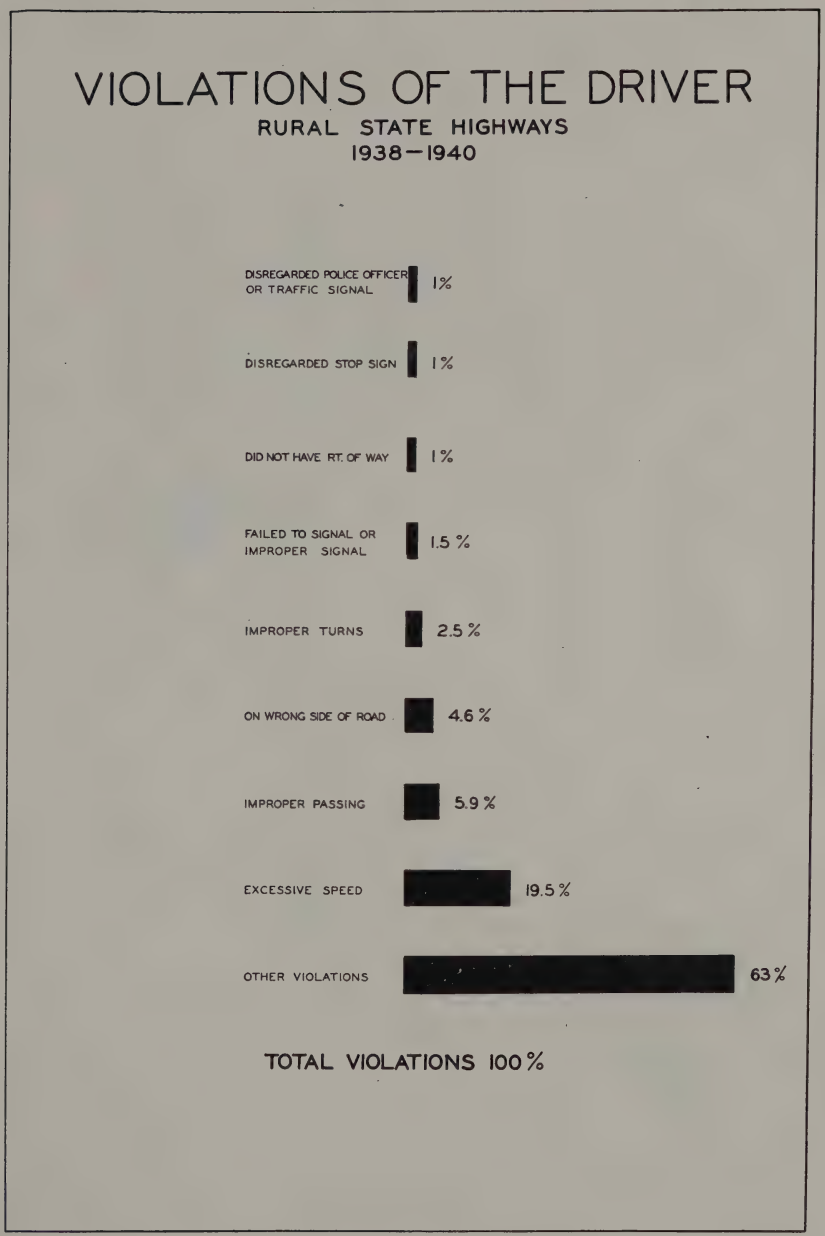
Structure No.	County	Location	Type of structure	Length in feet
B– 77	Clark	Underpass at Apex[1]	Steel I-beam, concrete abutments	58
B– 79	Clark	Underpass at Crystal	Steel I-beam, concrete abutments	72
B–195	Clark	Underpass in Las Vegas	Steel I-beam, concrete abutments	820
B–208	Clark	Overpass at Moapa	Steel I-beam, concrete girder approach spans	122
B–322	Clark	Underpass near Jean	Steel girders, concrete abutments	64
B–393	Clark	Underpass at Apex	Steel I-beam, concrete abutments	*116
B–399	Clark	Overpass near Glendale	Concrete slab on steel piles	†135
B– 52	Elko	Southern Pacific overpass at Deeth[3]	Steel I-beam, concrete piers and abutments	136
B –53	Elko	Western Pacific overpass at Deeth	Steel I-beam, concrete girder approach spans	129
B– 57	Elko	Underpass west of Wells	Steel I-beam, concrete abutments	100
B– 58	Elko	Overpass at Silverzone	Steel I-beam, concrete girder approach spans	135
B– 59	Elko	Underpass at Silverzone	Steel I-beam, concrete abutments	76
B–132	Elko	Overpass at Wendover	Steel I-beam, concrete girder approach spans	134
B–229	Elko	Overpass east of Wells	Steel I-beam, concrete girder approach spans	155
B–323	Elko	Western Pacific overpass west of Wells	Steel I-beam, concrete girder approach spans	116
B –35	Eureka	Overpass at Shoshone[1]	Steel I-beam, concrete piers and abutments	136
B– 38	Eureka	Overpass at Dunphy	Steel I-beam, concrete girder approach spans	163
B–324	Eureka	Overpass at Shoshone	Steel I-beam, concrete girder approach spans	220
B –30	Humboldt	Overpass at Rose Creek[1]	Steel I-beam, concrete piers and abutments	130
B– 31	Humboldt	Underpass at Winnemucca	Steel I-beam, concrete abutments	107
B–224	Humboldt	Winnemucca overpass	Steel I-beam, concrete girder approach spans	195
B–387	Humboldt	Overpass at Rose Creek	Steel I-beam concrete piers and abutments	*216
B–261	Lincoln	Underpass at Pioche[2]	Steel girder and steel bents	20
B–413	Lincoln	Underpass south of Caliente[2]	Steel I-beam, concrete abutments	20
B– 18	Lyon	Underpass west of Fernley	Steel I-beam, concrete abutments	112
B– 19	Lyon	Overpass east of Fernley	Steel I-beam, concrete girder approach spans	154
B–133	Nye	Underpass at Tonopah[2]	Timber trestle	23
B– 29	Pershing	Overpass at Woolsey	Steel I-beam, concrete girder approach spans	174
B–235	Storey	Virginia City overpass	Steel I-beam, steel bents	72
B–258	Washoe	Second Street underpass, Reno	Steel girder, concrete abutments	75
B–259	Washoe	Alameda underpass, Reno	Steel I-beam, concrete abutments	71
B–125	White Pine	[redacted]pass west of Ely[1]	Steel I-beam, concrete piers and abutments	73
B–130	White Pine	[redacted]pass at McGill[2]	Steel I-beam, steel piers	12
B–371	White Pine	Overpass west of Ely	Steel I-beam, steel and concrete piers	243
B–384	White Pine	Overpass at East Ely	Steel rigid frame	*177

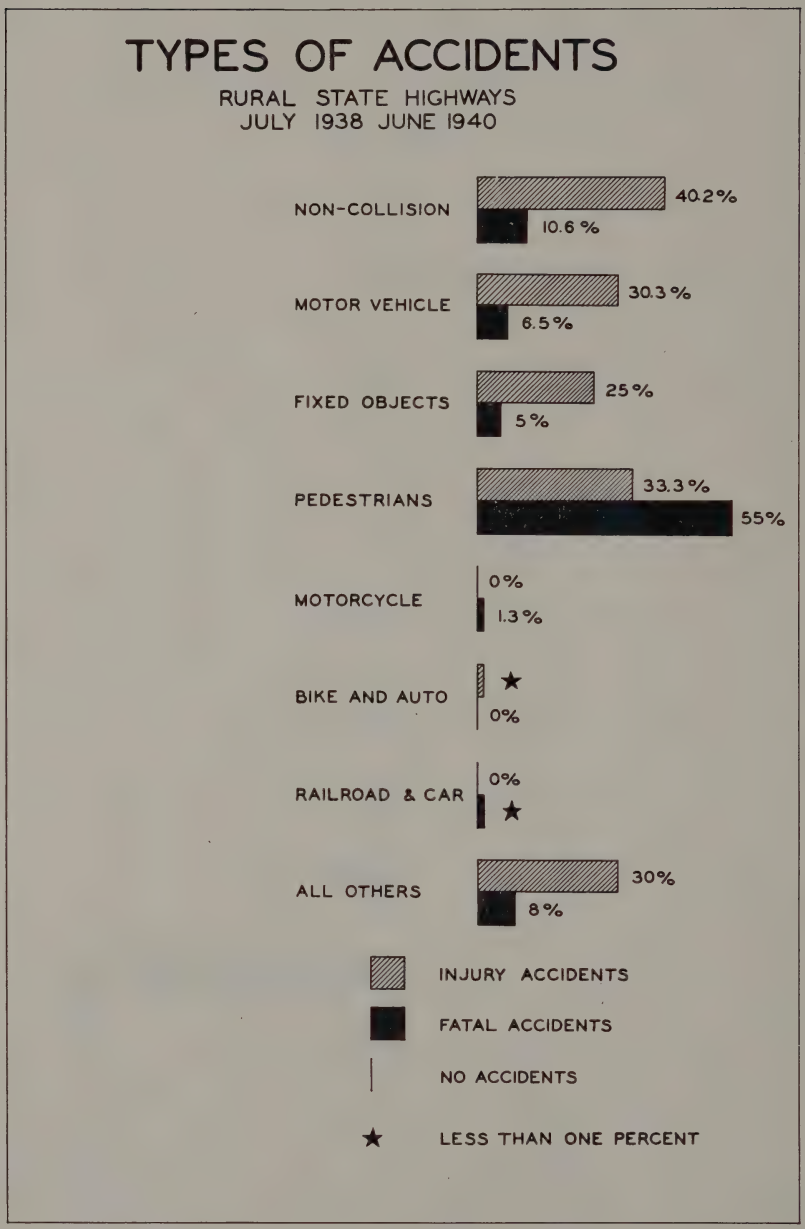
*Constructed during biennium. †Under construction as of June 30, 1940. [1]Abandoned during biennium due to relocation.
[2]Not built by State Highway Department. [3]Widened during biennium.

Table No. 25—Continued

BRIDGE AND GRADE SEPARATION SUMMARY

	Structures Built by State Highway Department						
	Completed or under construction as of June 30, 1938	Completed during biennium or under construction at close of biennium, June 30, 1940	Total	Structures on State Highway System not built by State Highway Department	Total structures on State Highway System	Structures abandoned during biennium	Total structures as of June 30, 1940
Mass concrete	0	0	0	1	1	0	1
Reinforced concrete	60	10	70	3	73	5	68
Structural steel	28	4	32	12	44	8	36
Timber bridges and trestles	54	0	54	26	80	0	80
Composite structures (reinforced concrete and structural steel)	11	0	11	0	11	0	11
Total	153	14	167	42	209	13	196
Total length of structures in feet	14,051	1,680	15,731	3,043	18,774	1,203	17,571


VIOLATIONS OF THE DRIVER
RURAL STATE HIGHWAYS
1938—1940
DISREGARDED POLICE OFFICER OR TRAFFIC SIGNAL
1%
DISREGARDED STOP SIGN
1%
DID NOT HAVE RT. OF WAY
1%
FAILED TO SIGNAL OR IMPROPER SIGNAL
1.5 %
IMPROPER TURNS
2.5 %
ON WRONG SIDE OF ROAD
4.6 %
IMPROPER PASSING
5.9 %
EXCESSIVE SPEED
19.5 %
OTHER VIOLATIONS
63 %
TOTAL VIOLATIONS 100 %


TYPES OF ACCIDENTS
RURAL STATE HIGHWAYS
JULY 1938 JUNE 1940
NON-COLLISION
40.2%
10.6%
MOTOR VEHICLE
30.3%
6.5%
FIXED OBJECTS
25%
5%
PEDESTRIANS
33.3%
55%
MOTORCYCLE
0%
1.3%
BIKE AND AUTO
★
0%
RAILROAD & CAR
0%
★
ALL OTHERS
30%
8%
INJURY ACCIDENTS
FATAL ACCIDENTS
NO ACCIDENTS
★ LESS THAN ONE PERCENT

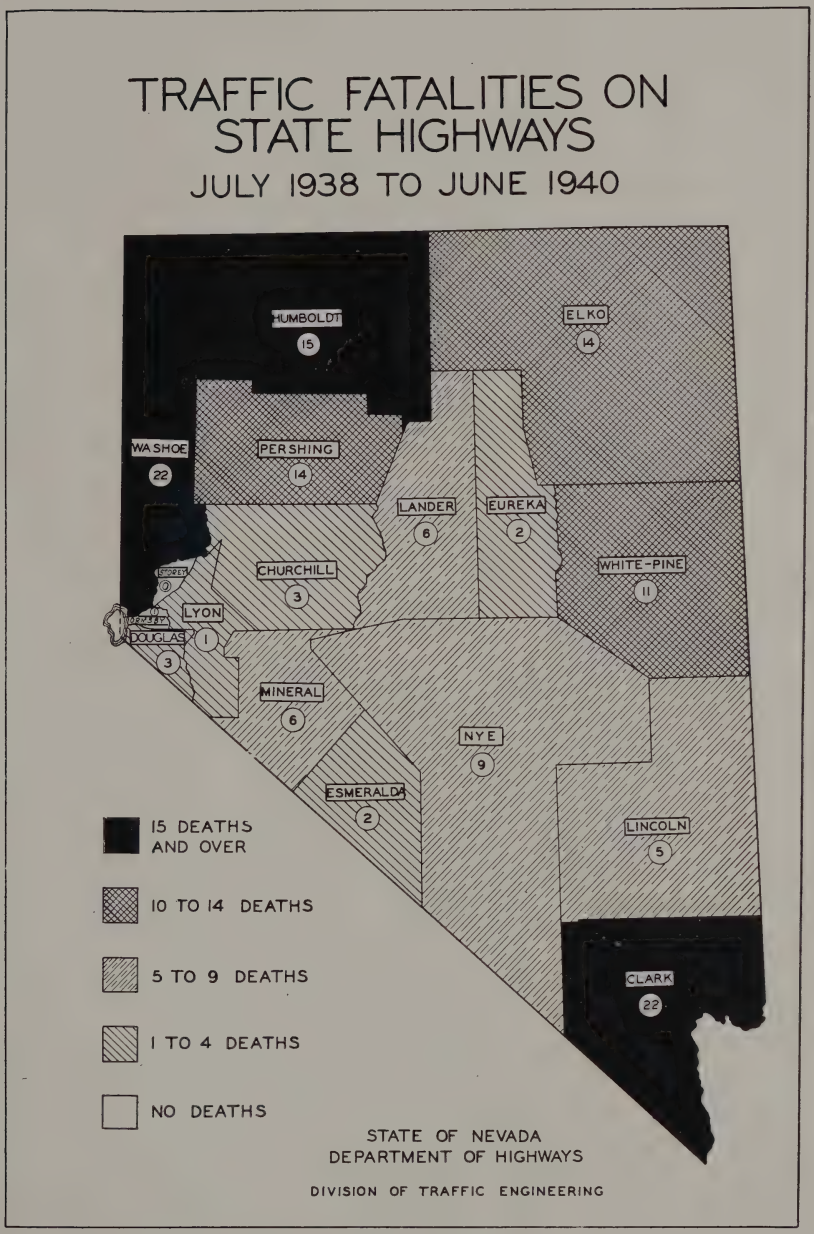

TRAFFIC FATALITIES ON STATE HIGHWAYS
JULY 1938 TO JUNE 1940
HUMBOLDT 15
ELKO 14
WASHOE 22
PERSHING 14
LANDER 6
EUREKA 2
WHITE-PINE 11
CHURCHILL 3
STOREY 0
LYON 1
DOUGLAS 3
MINERAL 6
NYE 9
ESMERALDA 2
LINCOLN 5
CLARK 22
15 DEATHS AND OVER
10 TO 14 DEATHS
5 TO 9 DEATHS
1 TO 4 DEATHS
NO DEATHS
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
DIVISION OF TRAFFIC ENGINEERING

TABLE NO. 26

PLANS COMPLETED, JULY 1, 1938, TO JUNE 30, 1940

County	Construction and reconstruction (miles)	Bituminous surface only (miles)	Bridges number	Other projects number	Cost of Plans	
					Roadway	Bridges
Churchill	21.034	8.457	3	2	$6,373.53	$1,387.41
Clark	51.827	.....	4	3	19,696.26	2,726.59
Douglas	11.785	.....	....	....	4,775.52	300.29
Elko	64.757	39.959	6	4	12,824.56	3,771.17
Esmeralda	9.815	9.815	....	....	812.88	
Eureka	15.676	4.618	2	2	6,824.51	1,526.86
Humboldt	37.359	17,935	1	3	5,765.71	45.65
Lander	28.241	.....	....	....	4,231.58	
Lincoln	19.904	9.952	....	....	1,254.46	
Lyon	30.942	12.100	....	2	7,297.19	23.00
Mineral	8.547	.....	....	1	1,152.02	
Nye	90.044	53.085	....	....	7,444.64	
Ormsby	5.589	.....	....	....	2,419.29	
Pershing	40.476	.....	....	2	13,448.94	1,510.85
Storey	5.581	5.380	....	....	1,751.92	
Washoe	6.143	.....	3	4	3,841.09	1,421.63
White Pine	14.483	20.312	3	....	7,562.98	3,215.56
	492.203	181.613	22	*23	$107,477.08	$15,929.01
Total cost, plans and estimates roadway and bridges						$123,406.09

*Other projects consist of three roadside improvement projects and twenty automatic grade crossing warning signal installations.

The above tabulation does not include mileage of partial plans for cooperative projects nor mileage of alternate designs prepared for securing comparative cost estimates.

TABLE NO. 27

TOTAL ACRES OF LAND ACQUIRED FOR HIGHWAY RIGHT-OF-WAY TO JUNE 30, 1940

Route	Private	Government	Total private and Government	Total cost through private land	—Cost per Acre— Private	All land
1	4,491.90	6,726.25	11,218.15	$84,811.82		
1A	111.99	1,309.91	1,421.90	100.00	$0.89	$0.07
1B	677.40	491.26	1,168.66	2,509.70		
2	655.23	11,578.84	12,234.07	24,263.58		
2A	525.09	1,704.95	2,230.04	1,415.54		
2B	128.46	442.36	570.82	380.00	2.96	.86
3	1,317.50	5,827.10	7,144.60	67,907.72		
3A	89.69	1,095.24	1,184.93			
4	235.03	6,293.82	6,528.85	156.00		
5	3,259.07	9,752.81	13,011.88	5,141.94		
6	365.02	5,694.92	6,059.94	5,955.33		
7	651.20	10,014.54	10,665.74	5,167.69		
8	249.02	2,913.02	3,162.04	1,225.03		
8A	125.56	3,674.58	3,800.14	1,836.99		
8B	88.23	531.34	619.57			
9	141.35	144.82	286.17	7,845.20	55.50	27.41
10	11.29	541.30	552.59	100.00	8.86	.18
11	144.95	477.02	621.97	786.64	5.43	1.26
11A	11.92	----------	11.92			
12	79.11	189.36	268.47			
13	398.83	5,572.57	5,971.40	1,077.27	2.70	.18
14	36.44	881.24	917.68	255.42		
15	7.20	1,051.28	1,058.48			
17	208.45	414.61	623.06	7,926.00		
19	23.14	9.83	32.97			
21	52.66	----------	52.66	116.00	2.20	2.20
21B	15.67	----------	15.67			
24	4.79	6,107.08	6,111.87			
26	----------	133.15	133.15			
27	30.47	----------	30.47	950.00	31.18	31.18
29	----------	802.51	802.51			
32	17.60	----------	17.60			
33	270.82	370.64	641.46	212.90	.79	.33
36	12.23	----------	12.23			
37	76.60	----------	76.60	1,367.00	178.46	178.46
38	43.50	301.66	345.16	820.00	18.85	2.38
43	407.18	602.03	1,009.21	940.00		
46	4.19	----------	4.19			
47	.50	971.40	971.90			
48	14.34	----------	14.34			
53	6.94	322.37	329.31			
58	----------	597.05	597.05			
59	11.92	----------	11.92			
62	13.98	----------	13.98			
Totals	15,016.46	87,540.86	102,557.32	$223,267.77	$14.87	$2.55

CHART NO. 1

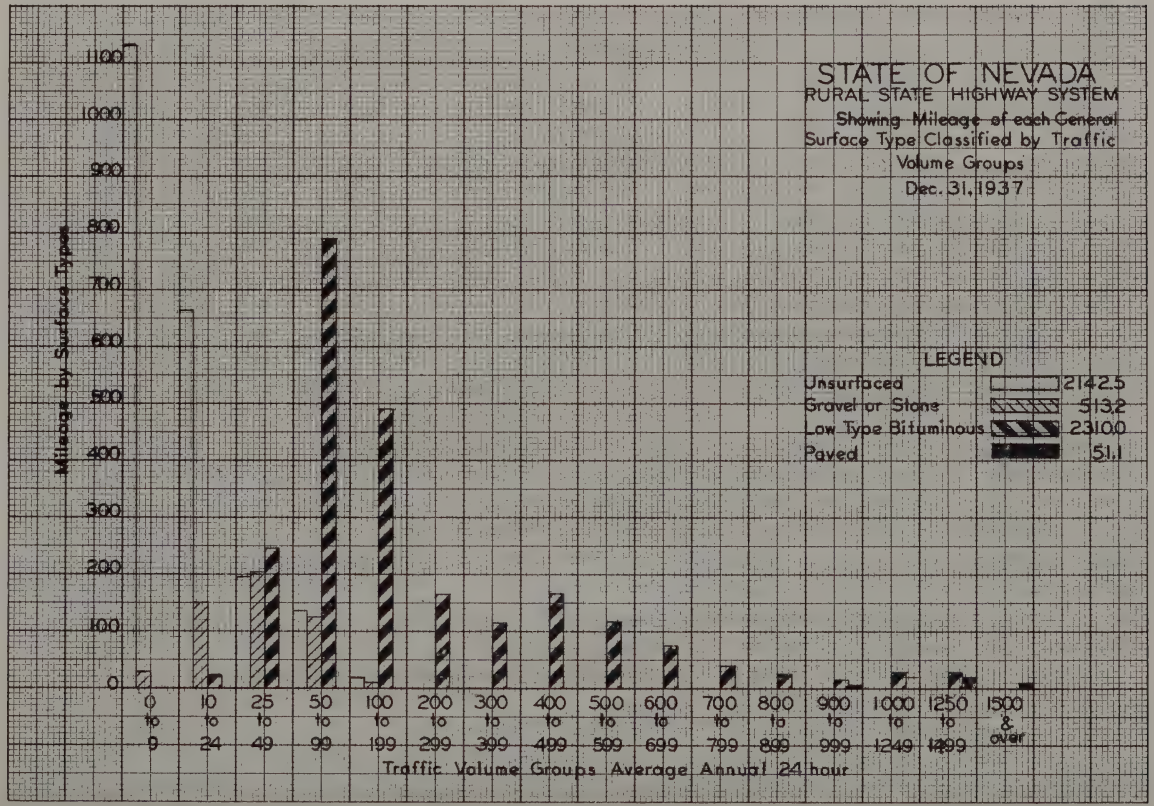
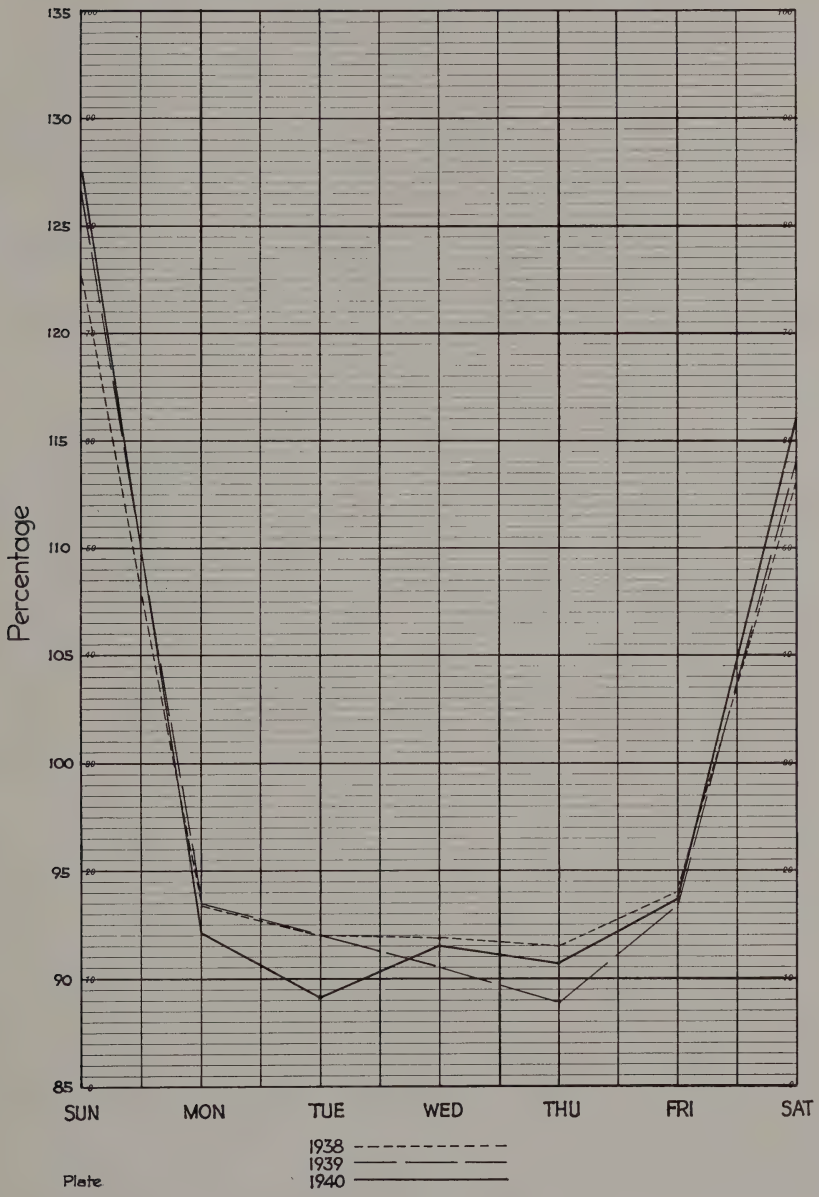

STATE OF NEVADA
RURAL STATE HIGHWAY SYSTEM
Showing Mileage of each General Surface Type Classified by Traffic Volume Groups
Dec. 31, 1937
LEGEND
Unsurfaced 2142.5
Gravel or Stone 513.2
Low Type Bituminous 231.00
Paved 51.1
Mileage by Surface Types
0
100
200
300
400
500
600
700
800
900
1000
1100
0 to 9
10 to 24
25 to 49
50 to 99
100 to 199
200 to 299
300 to 399
400 to 499
500 to 599
600 to 699
700 to 799
800 to 899
900 to 999
1000 to 1249
1250 to 1499
1500 & over
Traffic Volume Groups Average Annual 24 hour

CHART NO. 2

Percentage of Daily Average for the week by days of the week at Automatic Traffic Recorders.



Plate

CHART NO. 3

Percentage of the Annual Daily Average Traffic by Months at Automatic Recorders.

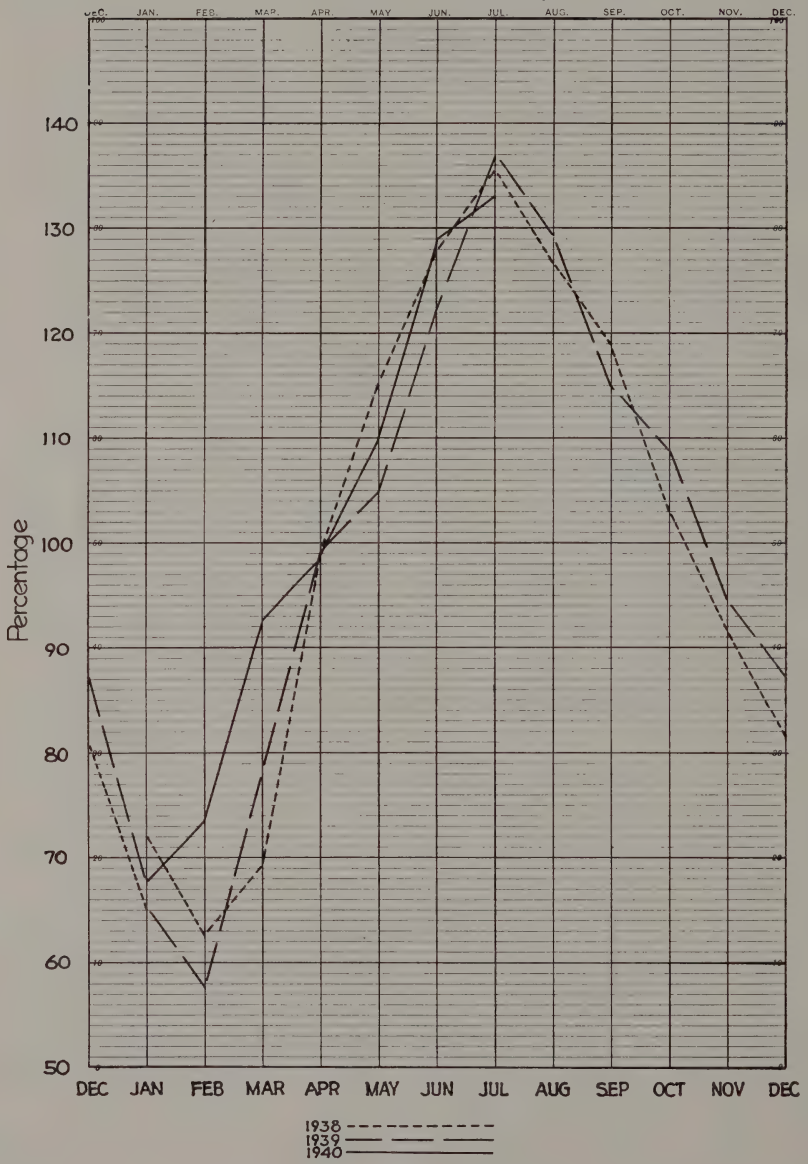


CHART NO. 4

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

STATE-WIDE HIGHWAY PLANNING SURVEY
Federal Works Agency – Public Roads Administration

MILEAGE OF RURAL ROADS IN NEVADA BY ADMINISTRATIVE SYSTEMS
DECEMBER 31, 1939

Administrative System

STATE	5134.0													
FEDERAL AID		2038.5												
NATIONAL FOREST			156.6	228.8		(409.7)			24.3					
NATIONAL FOREST DEVELOPMENT					24.3		(517.6)			493.3				
NATIONAL INDIAN RESERVATION						44.8		(156.6)			111.8			
NATIONAL MILITARY RESERVATION												44.7		
OTHER NATIONAL RESERVATION							8.7			(14.2)			5.5	
COUNTY								18,264.9						
MILES	2788.9	1881.9	156.6	228.8	24.3	44.8	8.7	17,585.3	24.3	493.3	111.8	44.7	5.5	23398.9
COMBINATIONS OF SYSTEMS	STATE	STATE and FEDERAL AID	STATE, FEDERAL AID and NAT. FOREST	STATE and NATIONAL FOREST	STATE and NAT. FOR. DEVELOPMENT	STATE and NATIONAL INDIAN RES.	STATE and other NATIONAL	COUNTY	COUNTY and NATIONAL FOREST	COUNTY and NAT. FOR. DEVELOPMENT	COUNTY and NAT. IND. RESERVATION	COUNTY and NATIONAL MIL. RES.	COUNTY and other NATIONAL RES.	ALL RURAL

CHART NO. 5

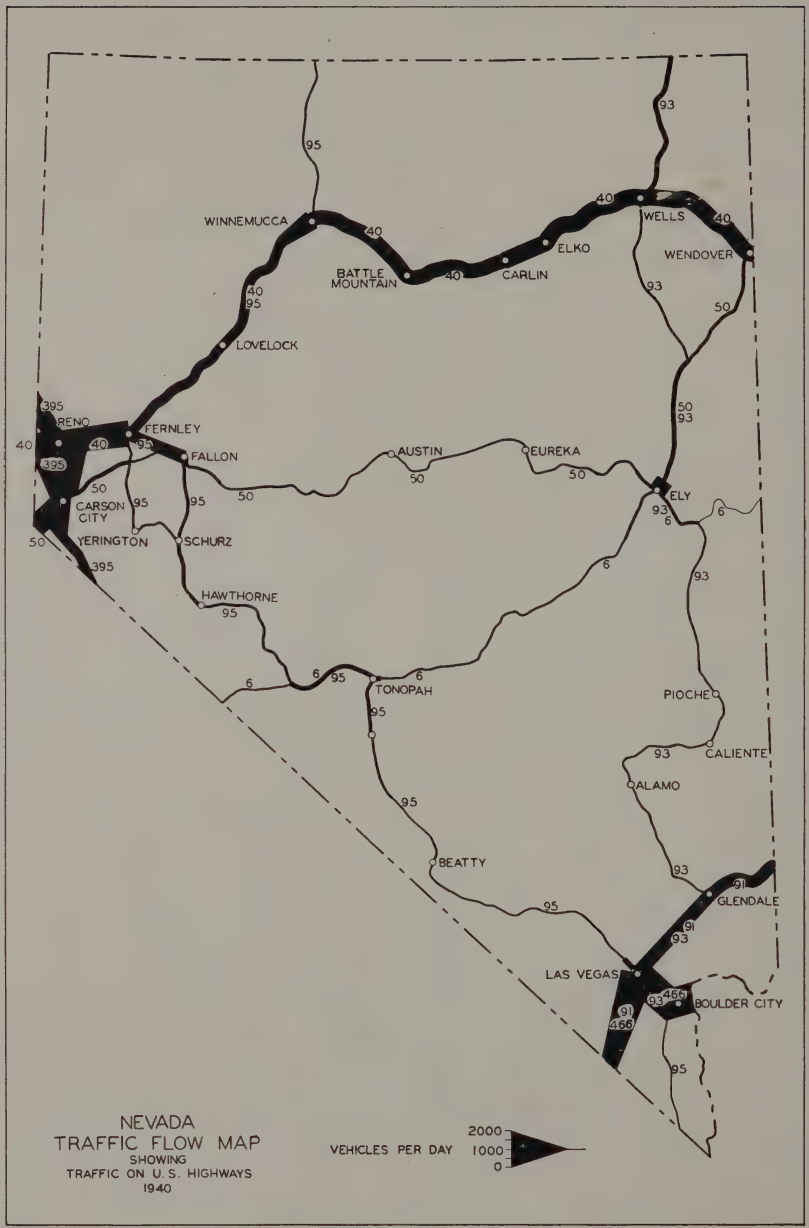

93
95
WINNEMUCCA
40
WELLS
ELKO
WENDOVER
BATTLE MOUNTAIN
CARLIN
LOVELOCK
50
395
RENO
FERNLEY
FALLON
AUSTIN
EUREKA
CARSON CITY
ELY
YERINGTON
SCHURZ
HAWTHORNE
TONOPAH
PIOCHE
CALIENTE
ALAMO
BEATTY
GLENDALE
LAS VEGAS
BOULDER CITY
NEVADA
TRAFFIC FLOW MAP
SHOWING
TRAFFIC ON U. S. HIGHWAYS
1940
VEHICLES PER DAY
2000
1000
0

TABLE NO. 28

HIGHWAY MILEAGE BY U. S. ROUTES

U. S. Route No.	Termini	Total mileage	Overlapping mileage*	Net mileage
6	California-Nevada State line near Basalt to Nevada-Utah State line near Baker	308.6	.....	308.6
40	California-Nevada State line near Verdi to Nevada-Utah State line near Wendover	417.6	.....	417.6
50	California-Nevada State line near Edgewood to Nevada-Utah State line near Wendover	469.2	1.8	467.4
91	California-Nevada State line near Jean to Nevada-Arizona State line near Mesquite	127.6	.....	127.6
93	Arizona-Nevada State line at Boulder dam to Nevada-Idaho State line near Contact	537.0	135.0	402.0
95	California-Nevada State line near Searchlight to Nevada Oregon State line at McDermitt	686.9	196.3	490.6
395	California-Nevada State line at Topaz to Nevada-California State line near Purdy	83.5	3.5	80.0
466	California-Nevada State line near Jean to Nevada-Arizona State line at Boulder Dam	74.1	74.1	0.0
Totals		2,704.5	410.7	2,293.8

*Most U. S. Routes overlap others for certain distances within Nevada. Overlapping mileage is that included in lower numbered routes only.

TABLE NO. 29

COMPARISON OF AVERAGE DAILY TRAFFIC AT AUTOMATIC RECORDERS FOR THREE-YEAR PERIOD

Station	Location	Daily Average 1938	1939	1940[1]
101	U S 40—Between Sparks and Vista	1,278	1,437	1,252
102	U S 91—Southwest city limits of Las Vegas	1,328	1,587	1,802
103	S R 46—½ mile south of south city limits of Elko	272	284	271
104	U S 395—1 mile northwest of north limits of Carson City	.....	.....	.....
106	S R 59—Near south city limits of Lovelock	194	229	197
107	U S 40—East city limits of Elko	707	852	794
108	U S 50 and 93—½ mile north of McGill	349	391	406
109	U S 93—½ mile south of city limits of East Ely	387	397	446
110	U S 93 and 95—1 mile southeast of Las Vegas city limits	1,485	1,592	1,684
112	U S 95—½ mile west of west limits of Tonopah	407	396	394
114	U S 95—3 miles northwest of north city limits of Las Vegas	[2]200	229	263
115	U S 40 and 50—0.4 mile west of Nevada-Utah State line	.....	.....	.....
116	U S 40—1 mile east of Nevada-California State line	.....	.....	.....
Totals		6,607	7,394	7,509
Percentage increase		.....	+11.9	+1.6

[1]Based on first 6 months traffic in 1940.
[2]Based on last 4 months traffic in 1938.
Recorders 104, 115, and 116 have not been operating at present locations for long enough period to provide comparison.

TABLE NO. 30

ANALYSIS OF TRAFFIC SURVEY COSTS, APRIL 3, 1936, TO JUNE 30, 1940, INCLUSIVE

Division	Expenditures			Number vehicles observed	Cost per Vehicle		
	Field	Analysis	Total		Field	Analysis	Total
Key	$12,592.55	$6,382.72	$18,975.27	286,216	$0.0440	$0.0223	$0.0663
Blanket	[1]27,343.90	9,510.35	36,854.25	151,338	0.1807	0.0628	0.2435
Loadometer	20,278.32	6,223.30	26,501.62	20,567	0.9860	0.3026	1.2886
Pit scale	18,516.48	4,145.21	22,661.69	6,609	2.8017	0.6272	3.4289
Automatic recorders (stationary)	15,619.03	9,648.88	25,267.91	11,345,024	0.001377	0.000850	0.002227
Automatic recorders (portable)	5,414.68	483.89	5,898.57	585,894	0.009242	0.000826	0.010068
Origin and destination	.....	2,330.76	2,330.76	64,785	.....	0.0360	0.0360
Special origin and destination	3,480.22	433.64	3,913.86	6,853	0.5078	0.0633	0.5711
Totals	$103,245.18	$39,158.75	$142,403.93	12,467,286	$0.008281	$0.003141	$0.011422

[1]Includes $10,922.56 W.P.A. funds.

TABLE NO. 31

THE POPULATION OF THE COUNTIES IN NEVADA FROM 1890 TO 1940

County	Population					
	1940	1930	1920	1910	1900	1890
Churchill	5,302	5,075	4,649	2,811	830	703
Clark[1]	16,347	8,532	4,859	3,321		
Douglas	2,046	1,840	1,825	1,895	1,534	1,551
Elko	10,844	9,960	8,083	8,133	5,688	4,794
Esmeralda[2]	1,553	1,077	2,410	9,369	1,972	2,148
Eureka	1,361	1,333	1,350	1,830	1,954	3,275
Humboldt[3]	4,745	3,795	3,743	6,825	4,463	3,434
Lander	1,745	1,714	1,484	1,786	1,534	2,266
Lincoln[1]	4,136	3,601	2,287	3,489	3,284	2,466
Lyon	4,144	3,810	4,078	3,568	2,268	1,987
Mineral[2]	2,327	1,863	1,848			
Nye[2]	3,562	3,989	6,504	7,513	1,140	1,290
Ormsby	3,209	2,221	2,453	3,415	2,893	4,883
Pershing[3]	2,768	2,652	2,803			
Storey	1,218	667	1,469	3,045	3,673	8,806
Washoe	32,366	27,158	18,627	17,434	9,141	6,437
White Pine	12,341	11,771	8,935	7,441	1,961	1,721
Totals	110,014	91,058	77,407	81,875	42,335	[4]47,355

[1]Clark organized from part of Lincoln in 1909.
[2]Part of Esmeralda taken to form Mineral in 1911, and part annexed to Nye in 1913.
[3]Part of Humboldt taken to form Pershing in 1919.
[4]Includes population (1,594) of Indian reservations, not distributed by counties.

TABLE NO. 32

ANNUAL REVENUE DERIVED FROM STATE MOTOR VEHICLE IMPOSTS BY CALENDAR YEARS[1]

Year	Type of Impost				
	Motor vehicle registration fees	Motor vehicle fuel tax	Motor carrier license fees	Petroleum products inspection tax[2]	Total
1939	$285,709	$1,336,301	$227,733	$21,275	$1,871,018
1938	266,611	1,198,484	193,431	17,840	1,676,366
1937	294,592	1,182,691	198,134	19,691	1,695,108
1936	279,429	1,096,942	199,943	16,609	1,592,923
1935	263,511	961,838	193,057	14,164	1,432,570
1934	246,828	894,192	138,947	11,725	1,291,692
1933	299,617	695,654	94,946	10,264	1,100,481
1932	332,973	727,117	62,207	11,839	1,134,136
1931	333,131	777,918	56,414	4,423	1,171,886
1930	330,222	677,835	48,332	.....	1,056,389
1929	296,530	636,831	25,662	.....	959,023
1928	249,111	527,680	18,846	.....	795,637
1927	229,839	467,142	17,282	.....	714,263
1926	209,920	400,851	1,589	.....	612,360
1925	209,231	301,473	292	.....	510,996
1924	181,970	154,515	.....	.....	336,485
1923	153,888	104,996	227	.....	259,111
1922	120,944	.....	441	.....	121,385
1921	102,410	.....	615	.....	103,025
1920	103,759	.....	333	.....	104,092
1919	37,110	.....	75	.....	37,185

[1]Amounts include costs of administration and collection.
[2]None of the revenue accruing from this impost is committed to highways or streets.

TABLE NO. 33

PERCENTAGE OF ANNUAL MOTOR VEHICLE IMPOSTS PAID IN NEVADA IN ACCORDANCE WITH SITUS OF OWNERSHIP*

Paid by vehicle owners resident in—	Registration fees	Motor fuel tax	Other motor vehicle imposts	Total
Unincorporated areas—				
Rural	31.3	19.7	11.7	20.5
2,500 and over	4.7	3.0	2.1	3.2
Incorporated places having a population of 1,000 or less	1.0	0.4	0.6	0.5
Total rural areas	37.0	23.1	14.4	24.2
Incorporated places having a population of—				
1,001 to 2,500	10.1	6.1	5.6	6.7
2,501 to 5,000	10.0	6.4	4.1	6.6
Las Vegas	7.2	4.9	5.4	5.4
Reno	21.4	14.1	11.5	15.0
Total urban areas	48.7	31.5	26.6	33.7
Total	85.7	54.6	41.0	57.9
Other	14.3	15.2	12.8	14.7
Out of State	.....	27.5	32.8	23.6
Total	100.0	97.3	86.6	96.2
Busses—				
Local	(†)	2.7	.....	1.9
Out of State	(†)	(‡)	13.4	1.9
Total	100.0	100.0	100.0	100.0

*Data collected for 1936, analysis completed in 1939–1940.
†Included in above distribution.
‡Less than $^1/_2$ of $^1/_{10}$ percent.

TABLE NO. 34

A COMPARISON BY PLACE OF RESIDENCE OF THE MOTOR VEHICLE OWNERS OF THE ANNUAL USE OF NEVADA HIGHWAYS AND CITY STREETS*

Place of ownership	On Rural Roads					On Municipal Streets Coming from or Going Directly to					Grand total Percent
	Federal aid Percent	State improved Percent	State unimproved Percent	Local Percent	Total Percent	Federal aid Percent	State improved Percent	State unimproved Percent	Local Percent	Total Percent	
Unincorporated areas—											
Rural	39.6	39.4	76.0	72.9	47.9	32.2	70.5	75.4	6.9	12.7	37.6
2,500 and over	4.9	13.1	1.7	12.6	7.3	2.7	0.4	------	0.1	0.6	5.3
Incorporated places having a population of 1,000 or less	1.2	0.1	0.2	1.9	1.1	0.2	(†)	(†)	------	0.1	0.8
Total rural areas	45.7	52.6	77.9	87.4	56.3	35.1	70.9	75.4	7.0	13.4	43.7
Incorporated places having a population of—											
1,001 to 2,500	14.0	7.5	5.9	4.9	11.0	4.9	11.3	4.3	11.7	10.3	10.8
2,501 to 5,000	13.1	7.3	8.9	3.6	10.3	31.4	6.0	19.9	11.2	15.2	11.7
Las Vegas	5.1	22.5	3.0	1.3	6.6	3.8	10.6	------	18.0	15.1	9.1
Reno	22.1	10.1	4.3	2.8	15.8	24.8	1.2	0.4	52.1	46.0	24.7
Total urban areas	54.3	47.4	22.1	12.6	43.7	64.9	29.1	24.6	93.0	86.6	56.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Data collected for 1936, analysis completed in 1939–1940.
†Less than $^1/_2$ of $^1/_{10}$ percent.

TABLE NO. 35

A COMPARISON OF THE ANNUAL USE OF THE NEVADA HIGHWAY SYSTEMS AND CITY STREETS BY PASSENGER CAR AND TRUCK OWNERS OF NEVADA RESIDING IN THE VARIOUS POPULATION GROUPS*

Place of ownership	On Rural Roads					On Municipal Streets Coming from or Going Directly to					Grand total
	Federal aid Percent	State improved Percent	State unimproved Percent	Local Percent	Total Percent	Federal aid Percent	State improved Percent	State unimproved Percent	Local Percent	Total Percent	Per-cent
Unincorporated areas—											
Rural	48.1	9.4	8.0	24.7	90.2	5.0	0.6	0.1	4.1	9.8	100.0
2,500 and over	39.8	26.8	1.6	28.5	96.7	3.3	(†)	.....	(†)	3.3	100.0
Incorporated places having a population of 1,000 or less	77.5	1.1	1.7	17.4	97.7	2.3	(†)	.....	.....	2.3	100.0
Total rural areas	47.5	11.4	7.1	25.1	91.1	4.8	0.5	0.1	3.5	8.9	100.0
Incorporated places having a population of—											
1,001 to 2,500	58.3	6.3	2.0	6.8	73.4	2.9	0.2	(†)	23.5	26.6	100.0
2,501 to 5,000	48.5	6.6	3.1	3.0	61.2	19.1	0.2	0.1	19.4	38.8	100.0
Las Vegas	25.0	26.7	1.1	1.7	54.5	2.4	0.5	.....	42.6	45.5	100.0
Reno	42.4	4.6	0.9	1.6	49.5	5.8	(†)	(†)	44.7	50.5	100.0
Total urban areas	43.6	8.9	1.6	2.8	56.9	7.6	0.2	(†)	35.3	43.1	100.0
Total	45.4	10.0	4.0	12.7	72.1	6.3	0.3	0.1	21.2	27.9	100.0

*Data collected for 1936, analysis completed in 1939–1940.
†Less than $^1/_2$ of $^1/_{10}$ percent.

TABLE NO. 36

DISBURSEMENTS FOR ROAD PURPOSES BY COUNTIES OF NEVADA FOR THE FISCAL YEARS 1937, 1938, AND 1939[1]

Item	1937	1938	1939
Direct expenditures—			
Primary State highways—			
Right-of-way	.....	$4,024	$3,032
Construction	$20		
Secondary State Highways—			
Right-of-way	.....	2,508	395
Construction	.....	4,648	744
County roads—			
Right-of-way	1,067	180	
Construction	9,434	13,674	19,383
Maintenance	383,090	367,350	382,637
Total	$393,611	$392,384	$406,191
Miscellaneous road expense not included in other items—			
Administration and engineering	$13,170	$12,206	$4,664
Equipment purchased	34,353	82,691	42,163
Other	13,150	32,468	6,870
Total	$60,673	$127,365	$53,697
Total direct highway disbursements	$454,284	$519,749	$459,888
Debt service (bonds)—			
Local road and bridge obligations—			
Interest	$785	$882	$1,171
Redemption	7,045	6,883	11,073
Total	$7,830	$7,765	$12,244
County-State highway obligations[2]—			
Interest	$14,515	$9,883	$7,153
Redemption	53,000	51,000	56,000
Total	$67,515	$60,883	$63,153
Total disbursements	$529,629	$588,397	$535,285

[1]The revenue from which these disbursements are made includes poll tax and all other taxes levied by the counties for general road and bridge purposes, together with Federal Forest receipts for road purposes. Does not include contributions or shared tax to other units.

[2]Does not include interest or redemption payments made by Douglas and Lyon Counties from State motor vehicle fuel tax revenue.

TABLE NO. 37

CIVIL AERONAUTIC AUTHORITY — **TECHNICAL DEVELOPMENT DIVISION, AIRPORT SECTION**

Type of community	Type of aircraft for which airport is designed	Planning classification	Technical Development Division —Airport Section— Recommended landing strip length with clear approaches at sea-level conditions
Small communities not on present or proposed airway system. Includes communities up to a population of approximately 5,000.	Small private owner type planes. This includes roughly planes up to a gross weight of 4,000 pounds, or having a wing loading (lbs./sq. ft.) times power loading (lbs./hp.) not exceeding 190. (See table.)	1	1,500′ to 2,499′
Larger communities located on present or proposed feeder line airways and which have considerable aeronautical activity. General population range 5,000 to 25,000.	Larger size private owner type planes and small size transport planes. This represents roughly planes in the gross weight classification between 4,000 and 10,000 pounds, or having a wing loading (lbs./sq. ft.) times power loading (lbs./hp.) of 190 to 230. (See table.)	2	2,500′ to 3,499′
Important cities on feeder line airway systems and many intermediate points on the main line airways. General population range 25,000 to several hundred thousand.	Present day transport planes in use as of January 1, 1939. Planes in this classification are represented approximately by those between 10,000 and 30,000 pounds gross weight, or by those having a wing loading (lbs./sq. ft.) times power loading (lbs./hp.) of 230 to 270. (See table.)	3	3,500′ to 4,499′
Cities in this group represent the major industrial centers of the Nation and important junction points or terminals on the airways system.	Largest planes in use as of January 1, 1939, and those planned for the immediate future. This approximately represents planes having a gross weight between 30,000 and 75,000 pounds, or having a wing loading (lbs./sq.ft.) times power loading (lbs./hp.) of 270 to 310. (See table)	4	4,500′ and over

NOTE—For scheduled operations of small transport planes 3,000′ is the minimum recommended. For other scheduled operations 3,500′ should be the minimum considered.

TABLE NO. 38

CIVIL AERONAUTIC AUTHORITY — **TECHNICAL DEVELOPMENT DIVISION, AIRPORT SECTION**

RECOMMENDED MINIMUM STANDARDS OF THE AIRPORT SECTION FOR AIRPORT SIZE, RUNWAYS, EQUIPMENT, ETC., FOR PLANNING CLASSIFICATION SHOWN

	Class 1	Class 2	Class 3	Class 4
Length of landing strips	1,500′ to 2,499′	2,500′ to 3,499′	3,500′ to 4,499′	4,500′ and over
Width of usable landing strips	300′	500′	500′	500′
Length of runways	None	2,500′ to 3,499′	3,500′ to 4,499′	4,500′ and over
Width of runways	None	150′ (night oper.) 100′ (day oper. only)	200′ (instrument) 150′ (night oper.) 100′ (day oper. only)	200′ (instrument) 150′ (night oper.) 100′ (day oper. only)
*Number of landing strips and runways determined by percentage of winds covered by landing strip and runway alignment	75%	80%	90%	90%
Facilities	Drainage Fencing Marking Wind direction indicator	Marking Wind direction indicator Drainage Lighting Hangar and shop Fueling Fencing Weather information Office space	Marking Wind direction indicator Drainage Lighting Hangar and shop Fueling Fencing Weather Bureau Two-way radio Visual traffic control Instrument approach system, when required	Same as for Class 3, but with administration building
Distance between center lines of parallel runways	.....	.....	700′ minimum	700′ minimum
Distance between center line of runway and airport buildings or aprons and loading platforms (instrument landing runway)	.....	700′ minimum	700′ minimum	700′ minimum
Distance between center line of runway and ariport buildings or aprons and loading platforms (other runways)	.....	250′ minimum	250′ minimum	250′ minimum

Landing strip and runway grades—Transverse	2½% maximum	2% maximum	1½% maximum	1½% maximum
Landing strip and runway grades—Uniform longitudinal	2% maximum	2% maximum	1½% maximum	1½% maximum
†Grade breaks—Longitudinal	—1½% to plus 1½% maximum	—1¼% to plus 1¼% maximum	—1% to plus 1% maximum	—1% to plus 1% maximum
Static design loads for runway and apron paving based on present day aircraft. Load considered distributed equally between two main wheels or sets of wheels	No paving recommended	30,000 lbs.	60,000 lbs.	100,000 lbs.
Probable future (10 years) maximum static gross loads to be considered in runway and apron paving design of drainage structures	No paving recommended	60,000 lbs.	150,000 lbs.	300,000 lbs.
‡Recommended design impact factor for paving to be applied to gross weight	No paving recommended	2	2	2
‡Recommended design impact factor to be applied to paving loads per unit area	No paving recommended	1¼	1½	1½
Probable range of static airplane tire pressures	10 to 25 lbs. sq. in.	15 to 50 lbs. sq. in.	30 to 75 lbs. sq. in.	50 to 85 lbs. sq. in.

*Landing strips and runways should be sufficient in number to permit take-offs and landings to be made within 22½° of the true wind direction for the percentage shown above of winds over 5 miles per hour, based on at least a 10-year Weather Bureau wind record where possible. All of the above landing strip and runway lengths are based on sea level conditions; for higher altitudes increases are necessary. One surfaced runway is recommended for the full length of each landing strip for airports in Classes 2, 3, and 4. Approaches to all landing strips and runways should be clear of obstructions within a glide angle of 20 to 1 as a minimum for all runways except instrument runways which should have clear approaches of 43 to 1.

†Longitudinal intersecting grades on a runway or landing strip should be joined by a vertical curve at least 500′ in length. It is also recommended that the distance between successive grade breaks be not less than 1,000′. In general, there should be no change in landing area grades of more than ½% in any 100′ interval.

‡Allowance for impact in paving design may be made either in terms of gross load or applied load per unit area. Both allowances in combination, however, should not be used.

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